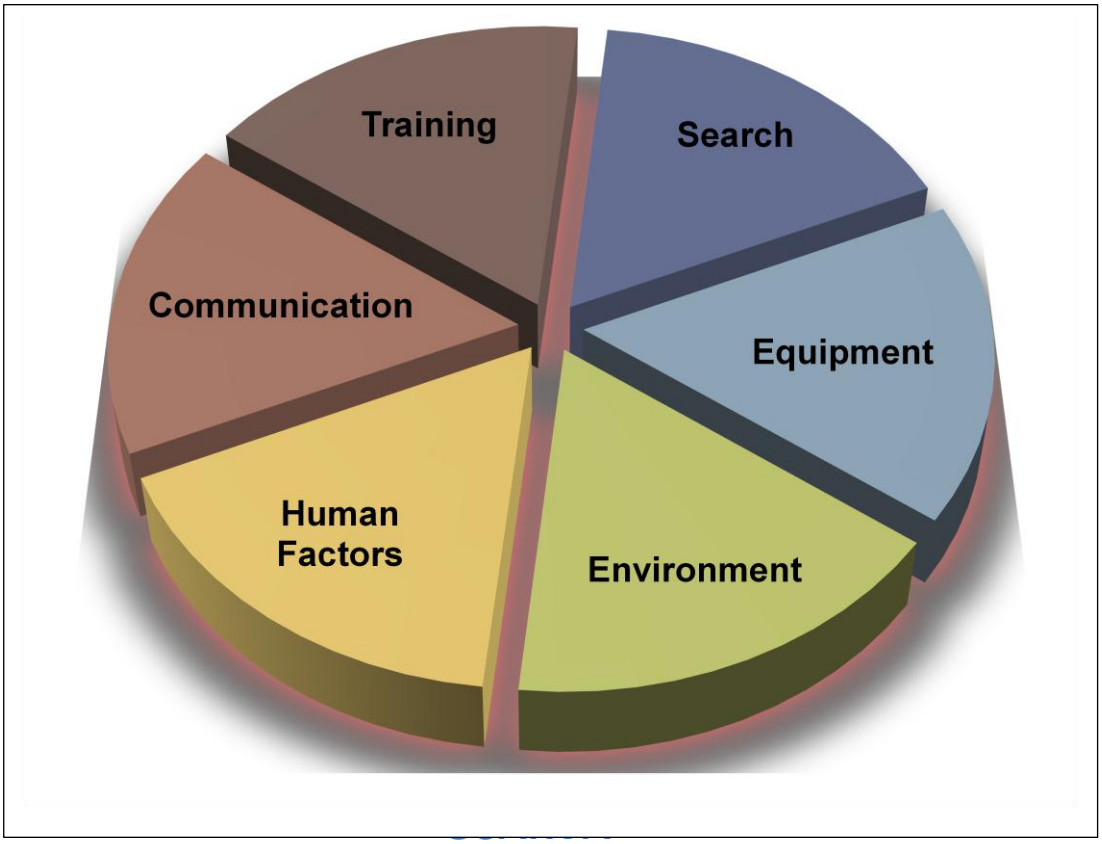
Ontario Search & Rescue Volunteer Association

Search Techniques Manual



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1 Introduction

1.1 Introduction

A Ground Search and Rescue (GSAR) volunteer is an individual who gives of his or her time and resources to become part of a team of other like-minded persons of varying backgrounds, to assist and support police agencies in finding a missing or lost person(s). They share many years of cumulative knowledge and skills. Furthermore, they each bring with them a commitment to train, learn, teach and support the efforts of their team, and as a group become a true asset to the police agencies they support and to the residents of the Province.

What the volunteer asks for in return from the GSAR community is the knowledge and specific GSAR training that will allow him or her to be an effective searcher. Much of what has been written about GSAR has focused on Search Management, Search Planning, Team Leadership skills, and available resources (including a variety of equipment and outside agencies). Several publications touch on the volunteer searcher's role, but in each there is an assumption that existing search training is adequate for them to do their job.

At some point in the search process, volunteers are placed on teams and sent out to find the *lost person(s)*.

This project researched and evaluated Search Technique *Best Practices* from GSAR teams in Ontario, other Provinces/Territories and from published SAR Standards. This manual shares those *Best Practices* and also includes recommendations for a series of field training exercises which are designed to improve search technique skills.

The project has drawn talent from across the Province by using OSARVA's existing network of qualified *SAR Trainers* to evaluate and develop the training aspects of this program. As *SAR Trainers*, we understand the need for ongoing training and development, and recognize that training must focus on the searcher's roles as effective team members and clue seekers.

At the point when the volunteer is placed with others to form an active *Search Team*, is the moment that the volunteer's focus becomes committed to the search. The volunteer then becomes an integral part of the *Search Process* and what he or she does impacts the results of the search. The volunteer's true responsibilities as a searcher and the need for their absolute attention and focus begin at this point.

The Approach - This search techniques manual is broken into six key sections. Combined, these sections properly and effectively cover all of the information and training needed to enhance a searcher's level of knowledge and provide them the skills required to effectively perform their search tasks.

- *Search* – This chapter examines how we search, the roles and responsibilities of volunteer searchers, and includes topics such as Search Patterns, Critical Distance, Cognitive Vision, Clue Detection, Team Safety and Protocols.
- *Equipment* – Volunteer searchers must carry specific equipment during a search to ensure the efficiency, accuracy and safety of themselves and other team members. Only then can they devote the focus and time needed in their search for clues.
- *Environmental* – This chapter highlights important environmental factors that a volunteer searcher may encounter at any point during a training exercise or an active search. It includes topics on natural hazards, weather, terrain and light.
- *Human Factors* – The individual searcher, in a team environment, must be able to function as a part of that team as well as focus on the task at hand. As a trained clue seeker, the volunteer must ensure that they can equally deal with the numerous distractions they will certainly be confronted with and ensure that their actions do not become a distraction to others.
- *Communication* – This chapter covers important information regarding radio communications and protocols with the command post and other teams, along with relevant communications within the search team itself. It also deals with how new issues which surround social media and the variety of electronic devices which could impact the team's performance.
- *Training* – Training in the use of equipment (GPS, map and compass) traditionally used during a search is discussed. This chapter also suggests several outdoor training exercises that can be used by teams to practice effective clue detection techniques. It also focuses as well on the volunteer searcher's ability to recognizing the numerous distractions and issues that reduces the capability to be an effective searcher.

In their role as *searchers*, when activated by the Ontario Provincial Police (OPP) and Municipal Police Services, GSAR volunteers bring a variety of personal skills that assist in finding the missing or lost person(s). The perfection of these skills is paramount to their confidence and enthusiasm and we believe makes them better volunteers. They remain active in their teams and have an opportunity to pass on their skills to new people who are eager to get involved.

Search techniques are complex. We know that one's ability to effectively search is affected by many factors, including personal and team issues, a variety of outside influences and distractions, as well as environmental concerns and barriers. Searching requires training, confidence, commitment and concentration. Basic tracking skills along with good equipment, strong leadership, teamwork, proper briefing and direction and much more is needed to make a person a good searcher. Field exercises and search

patterns were designed to account for all hindrances to *effective searching* and we specifically included training to account for one's basic Cognitive Vision errors.

Volunteer GSAR Teams in Ontario have developed independently over the years and have traditionally followed search methods suggested by conventional SAR Standards. They realized that there was a need for more intense and directed training of their volunteers. Teams began to develop independent training exercises and field techniques to increase volunteer skill levels and improve their opportunity for success. Their ultimate goal is to find the lost person. The Ontario Search and Rescue Volunteer Association and GSAR trainers built on those initiatives and created an advanced training manual along with effective field exercises to standardize Search Techniques Training for all teams in the Province.

OSARVA is a non-profit organization. It operates under a Memorandum of Understanding (MOU) with the OPP and acts as the umbrella agency for Ontario Volunteer SAR Teams. OSARVA provides guidance, certification training, SAR training, identification and record keeping, as well as being the liaison with the OPP. OSARVA's main focus has been to ensure that all team volunteers are properly trained to do the job that they are being tasked to do "find the lost person".

The Ontario Search and Rescue Volunteer Association and its member teams would like to acknowledge the financial support of the Government of Canada for this project through the Search and Rescue New Initiatives Fund.

1.2 Search is an Emergency

OBJECTIVES: To familiarize searchers with factors that make search and rescue (SAR) incidents emergencies and evaluate the relative urgency of these incidents.

Any SAR incident is an emergency! This means any report of an overdue person(s) must be treated with as much seriousness as a report of a school bus accident or multiple vehicle collision. One or more person's lives may be in danger - a sizeable number of victims die in SAR incidents. However, you must also remember that searches can cause intense press, public, and political interest. No other type of incident, if mishandled, has so great a potential for disastrous publicity or legal liability for you.

Five factors making a search and rescue response necessary:

- A delay in alerting authorities of the missing or lost person(s).
- The odds of this person(s) surviving, as time goes on.
- Size of the search area.
- Available information.
- Time is a clue eraser.

Matching response with need - Every report of a possible SAR incident must be treated as an emergency. A call with a low probability that someone is in danger, may only need some phone calls. A call with a high probability demands a greater response (you move all available resources).

How can you make that judgment? - Experience helps, but the questions that follow may assist you in evaluating the situation. There are simple yes or no questions you can ask and the more yes's you get the more urgently you should treat the situation.

- Is the subject very young or very old?
- Does the subject have a known or potential medical problem?
- Is there only one person involved?
- Is the individual reasonably overdue, measured by standards normally used to determine that someone is overdue?
- Are less than 8 hours of daylight left?
- Are weather conditions bad now, or were they when the person went missing?
- Was the subject poorly equipped to handle the environment?
- Is the subject inexperienced in the environment and/or the local area?
- Are known hazardous conditions in the area?
- Is the person(s) missing in an area in which there have been numerous SAR incidents?

Table 1-1 Urgency Response depicts factors that when matching your response to these factors, can give you a numerical answer to whether the urgency should be *High, Intermediate* or *Low*.

Factor	Rating	Score
Subject's Age		
Very young	1	
Very old	1	
Other	2 - 3	
Subject's Medical Condition		
Known or suspected injury, ill or mental illness	1 - 2	
Healthy	3	
Known fatality	3	
Number of Subjects		
One, alone	1	
More than one (very young, very old)	1 - 2	
More than one (unless separation is suspected)	2 – 3	
Subject's Experience		
Inexperienced – does not know area	1	
Inexperienced – knows area	1 – 2	
Experienced – knows area	3	
Weather Profile		
Past and/or existing inclement weather	1	
Predicted inclement weather (8 hours or less)	1 - 2	
Predicted inclement weather (8 hours or more)	2	
No inclement weather predicted	3	
Equipment Profile		
Inadequate for environment and weather	1	
Questionable for environment and weather	1 - 2	
Adequate for environment and weather	3	
Terrain Profile		
Difficult or know hazards	1	
Moderate terrain/minimal hazards	1 - 2	
****Consider elapsed time in response determination****	***Factor***	
If any of the factors rate as a 1, regardless of total, the search requires the highest urgency.		
Response Decision		

8	10	12	14	16	18	20
Highest Urgency		***Intermediate Urgency***			***Lowest Urgency***	

Table 1-1 Urgency Response

2 Search

OBJECTIVE: The purpose of this chapter is to give the basic searcher an understanding of search patterns and techniques and how they relate and are used during a search.

While on search, team leaders should never have to explain the workings of a search pattern to team members. The searcher should be prepared when arriving at a search, which includes having their required equipment, being familiar with the equipment being used (i.e. GPS, compass, flagging tape, hip chains etc.) and know the different search patterns. The searchers must know their roles and responsibilities and what is expected of them. When this chapter is completed, the searcher will know, understand and be able to function effectively as part of a search team.

Search - defined as, looking for an overdue, missing or lost person(s) whose location is unknown.

2.1 How We Search

When ground search and rescue teams search, several different resources are used. They may include SAR dogs, mountain bikes, ATV's, snowmobiles, canoes, boats, horses, etc. Almost always, teams of experienced, clue wise searchers on foot are required.

There are two types of initial response search methods:

- *Passive Method* - uses attraction methods to assist in locating the missing or lost person(s).
- *Active Method* - searchers actively searching for and/or containment the missing or lost person(s) or clues.

The following list is how a searcher should be searching:

- When searching remember, travel through the search area slowly, not more than half your normal speed of travel.
- Be clue conscious; always be on the lookout for clues. There are many more clues than missing or lost person(s).
- Keep focused on the task at hand. No phone calls, texting, picking berries, or idle talk.
- Use your senses; smell, hearing and sight.
- Consciously stop and listen, look up and down, side to side (right to left) and to the rear.

    - Kids will climb or burrow.
    - A lost person if injured will be on the ground and taking refuge creating a small target.
    - Look behind to see something from a different angle and perspective.
- Try to imagine what the subject would do in this environment and situation.
- Maintain a positive attitude and outlook.
- Never assume anything.
- Use sound attraction.
- Know your limitations and convey them to your team leader.
- Always be alert to your surroundings.

2.1.1 Why do we Search

As a SAR team member, it is important to remember why you are in the field. Your job is to find the missing or lost person(s) or to find clues related to this person(s) or to eliminate search areas. If your team is in the field and discovers a solid clue, then your team has assisted in the search by advancing the Last Known Position (LKP). By connecting the various clues and positions, it will often draw a line directly to where the missing or lost person(s) will eventually be found.

So, it is important when you are in the field, regardless of what duty you are assigned, to always remember to watch for clues and report anything you find. Each piece of the mystery, gives a clearer picture of what happened and how the person(s) might be found.

2.2 Search Patterns

In order to maintain an organized structure and use available resources efficiently, several different search patterns and techniques are utilized.

Imagine searchers, canine units, trackers and helicopters all searching the same area with no structure and no way of recording what was searched. It would be like playing a game that no one knew, with no rules and no way to keep score.

In the initial stages of the search, the search area may be very large and the number of resources limited. A rapid deployment of search resources to areas of high probability may quickly reduce the size of the search area. If it can be determined what area the missing or lost person(s) is in, then that area can be contained to ensure subject does not leave the area. Then search resources can be concentrated to that area.

The following are the different types of search patterns and techniques utilized:

- Grid Search
- Hasty Search
- Track Crawl
- Binary Search
- Contour Search
- Perimeter Search
- Purposeful Wandering
- Attraction Methods (sound/visual)
- Confinement Methods

Positions required on search team to conduct the above search patterns and techniques:

- Team Leader
- Flag Person(s)
- Communications Person
- Navigator
- Medic/First Aider
- Note Taker
- Searcher

NOTE

Refer to ***2.6 Critical Distance / Spacing*** for more information.

2.2.1 Grid Search

Definition of grid - a network of horizontal and perpendicular lines, uniformly spaced, for locating points on a map, chart, or aerial photography by means of a system of coordinates.

Grid search utilizes many of the same principles as mentioned above. Grid search is used when the initial quick response search has been unsuccessful in locating the missing or lost person(s), or subject is believed to be unresponsive, or when a substantial clue has been found that would imply that the missing or lost person(s) is in the area in question. Because of the number of person-hours required to grid search an area, the area should be small and be an area where a high Probability of Detection (POD) has been assigned. Closed grid searches are usually used as a last resort because of the manpower required.

Searcher Spacing	POD	Search Hours / 1 km²
40m	33%	55 hrs*
20m	67%	110 hrs*
10m	83%	220 hrs*
5m	92%	440 hrs*
2m	97%	1100 hrs*

Table 2-1 – Person-Hour / POD

**These numbers are an approximate only and can be influenced by many variables.*

2.2.1.1 Single Line Grid Search

A closed grid search team will usually consist of between 6 and 10 searchers. Any more than 10 searchers and the search line will become very difficult to manage.

Figure 2-1 Single Grid Line

The search area could be flagged by an advance team marking its borders. If the search area has been flagged by an advanced team, then its borders have been clearly marked with flagging tape, hip chain or marked by a natural boundary (river, road, etc.).

The search team will line up along a baseline, usually a road, path or natural feature. The team leader must maintain radio contact with command post and all searchers should be tracking their sweeps with a GPS (if available). The searchers at the end of the search line will follow the boundary line laid out by the advance team. Searchers line up perpendicular to the boundary line and using the searcher that is following the boundary line as a guide, move in a single line maintaining a uniform distance between each member. The team will advance at the speed of the slowest searcher. In order to be as thorough as possible, searchers while traveling must look back, side to side (right to left) and up and down (including under vegetation etc.).

On occasion the terrain may present obstacles like swamp, thick brush, or windfalls. Searchers must be disciplined and determined to search thoroughly (with due regards to their own safety). If an area must be circumvented, the team leader must be informed and the area must be documented.

Searchers should not be talking unnecessarily as it is distracting. Searchers must maintain focus. The team should also be calling out to the missing or lost person(s) and stopping occasionally to listen for a response.

If the entire search area between the boundaries cannot be covered in a single sweep, the searcher farthest away from the searcher that is following the boundary line will be flagging the teams outside search boundary to ensure none of the search area is missed and setting the boundary for the next sweep. The search team will travel the required distance into the grid. If the entire search area is covered with one sweep then the team will stop at the end of the sweep, report to command post and wait for further instructions. ***Figure 2-2 Grid Search***, illustrates the different ways the distance between searchers can be controlled when the teams can cover the entire search area in one sweep.

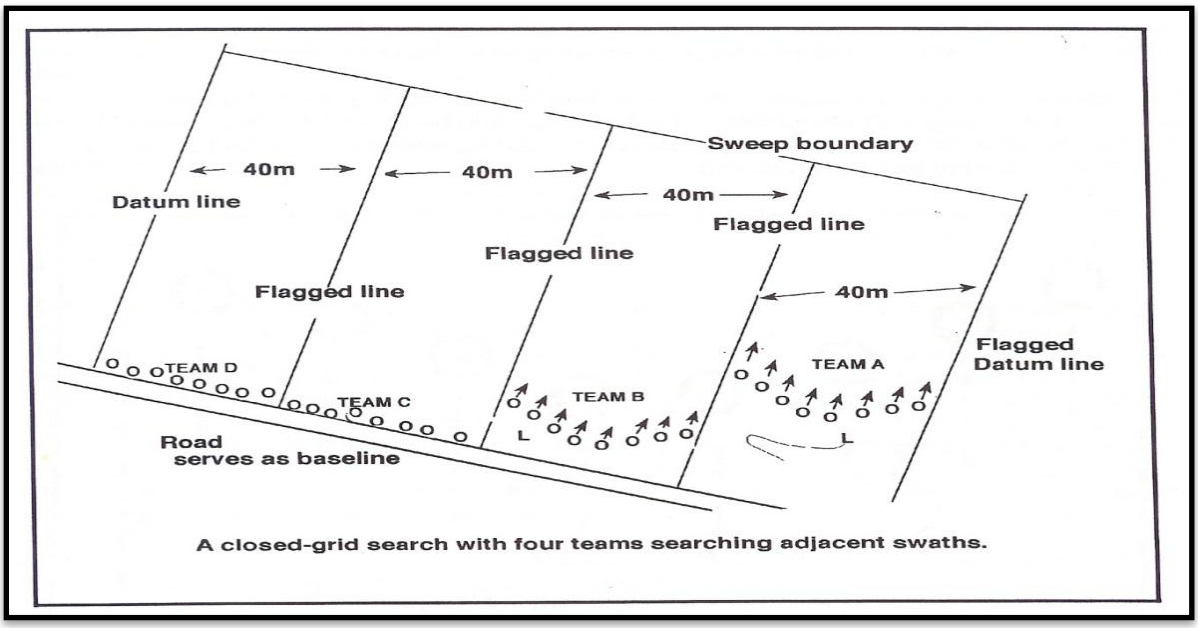

Figure 2-2 Grid Search

If the search area has not been flagged by an advanced team, then both searchers on either end of the line must flag the search area covered by the team. Since there are no marked boundaries, the team leader will select a navigator whose job is to ensure the team stays on the required bearing for the required distance.

NOTE
If a hip chain is used, it can measure distances travelled.

The spacing between searchers will be decided by the team leader based upon weather, type of ground, visibility, fatigue of searchers, size of clues being looked for etc. Upon completion of the sweep, the team leader will communicate with command post to report status and await further instructions.

2.2.1.2 Stagger Line

The team leader will normally be positioned behind the grid line in order to better manage and control the line. The team leader may also use different patterns or techniques depending on many variables. He/she may have the team search on a *staggered line*. The searcher following the boundary line will act as a guide. The searcher beside this person will stay behind by approximately a pace and the team member next to him/her will stay behind by a pace and so on.

NOTE

Constant checking of your position may distract from clue detection.

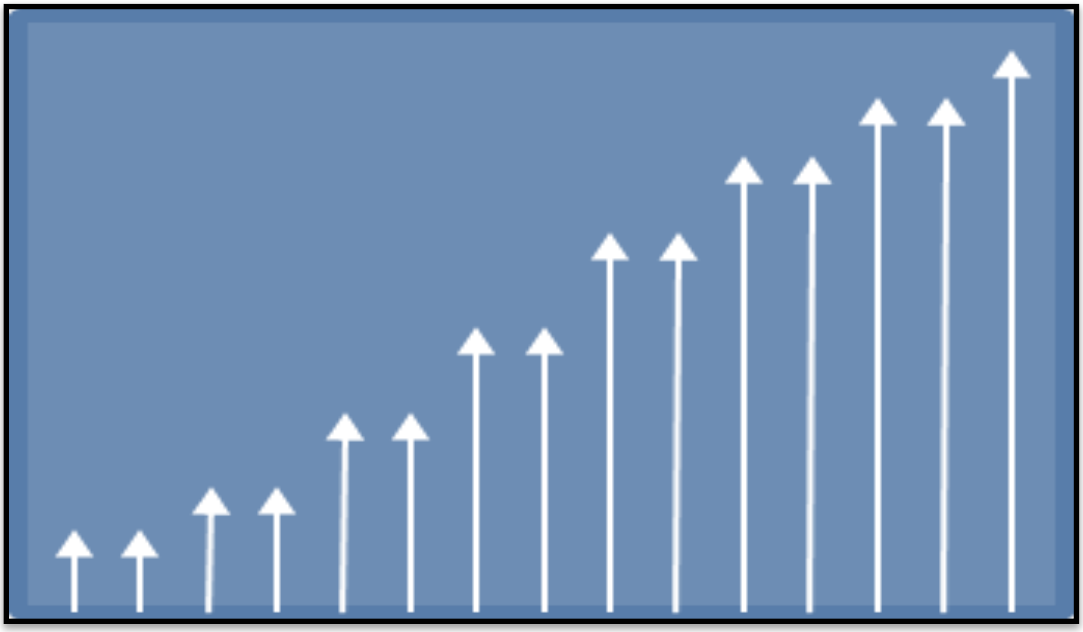

Figure 2-3 Staggered Line

2.2.1.3 Sagging Line

Another way for the team leader to better manage and control the grid line is to use the *sagging line*. This method works best when the entire area between the boundaries lines can be completed in a single sweep. The 2 outside searchers will follow the boundary lines and are used as guides, while the searchers beside them are approximately a pace back, and so on until the searcher in the middle of the line is at the farthest point back. By using the angular line or the sagging line techniques, searchers use their peripheral vision to see their guide searcher and can maintain uniform distance while searching for clues.

NOTE

Constant checking of your position may distract from clue detection.

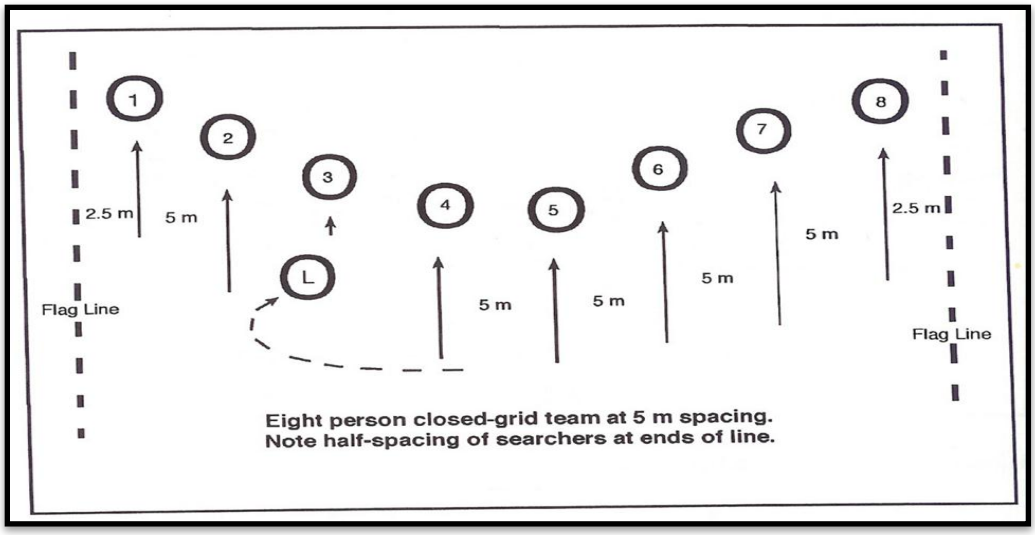

Figure 2-4 Sagging Line

Practical Exercise

Flag off an area 50m by 50m. Line up a team of searchers on one of the boundary lines. Assign roles to each of the searchers, team leader, communication person, flag person and navigator. Question searchers to ensure each person knows and understands what they are tasked with. Have the team search the entire area. Monitor the team to ensure search is performed correctly and to answer any questions that may arise during the exercise. After exercise is completed, debrief and evaluate the team.

The first exercise should not have more than 6 searchers to keep the complexity low and to build up confidence in the team members. Have the searchers use the tools of the trade, i.e. GPS, hip chain, compass, radio and flagging tape. The more they handle the tools the more comfortable they will become with them.

NOTE

This exercise can be expanded easily by adding clues, additional searchers, etc.

2.2.1.4 Pivoting Line

This search technique is utilized while team conducts a single line search pattern. When a team cannot cover the entire search area in a single sweep and must do a second or third sweep to complete the search area, a pivoting line is used. The team will complete the first sweep as described in the single line search. The team will then pivot sideways and makes a second sweep at 180º to the original. The searcher at the inside end of the line, (the one following the flagging tape laid by their team mate) will act as a guide for the line of searchers and will remove the flagging tape as the team moves forward. The searcher on the outside end of the line will flag that boundary on this second sweep. This process will continue until all the area has been covered. All searchers should be tracking each sweep with GPS (if available).

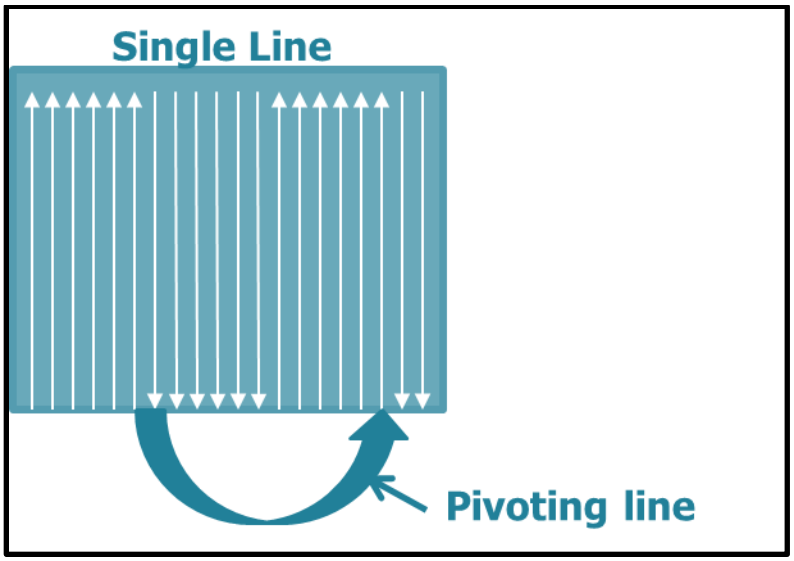

Figure 2-5 Pivoting Line

NOTE

It is the team leader's responsibility to maintain control and manage the line/searchers at all times. Searchers can assist by staying focused with task at hand.

Practical Exercise

Use the same exercise as single line search but when the team reaches the back boundary of the search area have them pivot around and do a second sweep. Have the searchers use equipment normally used on search.

2.2.1.5 Staggered Team Lines

To maintain control of a search line with a large number of searchers (10 or more) is difficult. If there are a large number of searchers available to search a single search area it is often easier to divide the searchers up into several teams. The first team will line up and do the first sweep the same as a single line grid search. The searcher on the outside end of the line will flag on the team's outer boundary. The second team will deploy shortly after the first team, using the first team's flagging tape as their guide and laying flagging tape on their outer boundary. The searcher following the first team's flagging tape will remove it as the team moves forward. The same will happen for every team until the search area is covered. Upon completion of each sweep, the team leaders will inform command post and await instructions. This search pattern requires team leaders for each team. All searchers should be recording their sweeps using GPS (if available). See ***Figure 2-2 Grid Search*** which illustrates this technique.

Practical exercise
Flag off an area 50m by 50m. Line up the teams of searchers on one of the boundary lines. Assign roles to each of the searchers. Have the searchers perform a search of the area utilizing the staggered team line technique. Follow through on each sweep, evaluating and answering questions.

NOTE
This exercise can be expanded easily by adding clues, additional searchers, etc.

2.2.1.6 Over-Lapping Lines

The over lapping sweep is executed the same as the single line grid search except that 2 teams are deployed at 180º to each other (one team leaving from the back border of the search area and one leaving from the front border). The outside person on the search line must lay flagging tape. This search pattern can be effective because the line of sight from one team to the other is 180º, which will often allow a possible clue that one team missed to be spotted by the other team.

NOTE
This search pattern can only be performed if spacing of the 2 search teams is strictly maintained. Should 2 searchers (one from each team) meet face to face then the sweep was less effective, and clues may have been missed.

This technique is normally utilized when a high POD is called for. This search method can only be used in small areas because of the difficulty of controlling it. All searchers should be recording their sweeps using GPS (if available).

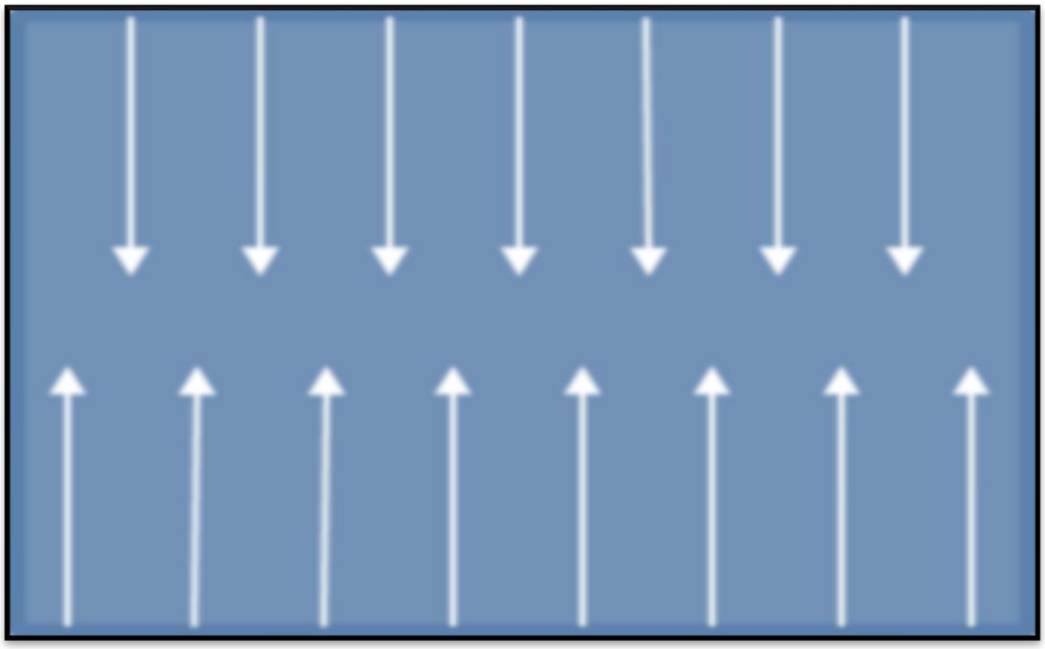

Figure 2-6 Over Lapping Lines

Practical exercise
Flag off an area 50m by 50m. Line up a team of searchers on one of the boundary lines. Have a second team of searchers line up on another boundary line at 180º to the first team. Assign roles to each of the searchers, team leaders, communication persons, flag persons and navigators. Question searchers, ensure each person knows and understands what they are to do. Have the team search the entire area. Monitor the team to ensure search is performed correctly and to answer any question during the search. After exercise is completed, debrief and evaluate each team's performance.

The first exercise should not have more than 6 searchers to keep the complexity low and to build up confidence in the team members. Have the searchers use the tools of the trade, (i.e. GPS, hip chain, compass, radio and flagging tape). The more they handle the tools the more comfortable they will become with them.

NOTE
This exercise can be expanded easily by adding clues, additional searchers, etc.

2.2.1.7 Groupings
This pattern consists of several teams each consisting of two searchers and a team leader/navigator. The teams line up on a base line. The navigator/team leader must ensure the team stays on their assigned bearing. The searchers will maintain a predetermined separation from start to finish.

The separation between teams will be based on terrain, weather, searcher fatigue etc. All searchers should be recording their sweeps using GPS (if available).

2.2.1.8 Multiple Passes
The search area should be clearly marked whether with flagging tape, hip chain or natural boundaries. The search team will line up on the baseline and search the search area the same as a single line search. Once the search area has been covered, the search team will then line up on one of the outside boundaries of the search area and repeat the search of the area at 90º to the first sweep. This technique may also be used with other search patterns (staggered line, overlapping, and groupings). All searchers should be recording their sweeps using GPS (if available).

The benefits of performing search patterns with multiple passes are:
- The area being searched two or more times will give a higher POD.
- The view of the searcher is changed; allowing searchers to search an area from a different angle (could find clues missed on previous sweeps).

NOTE
This is a very time consuming technique and usually used as a last resort in an area with a high POD, or for an evidence search.

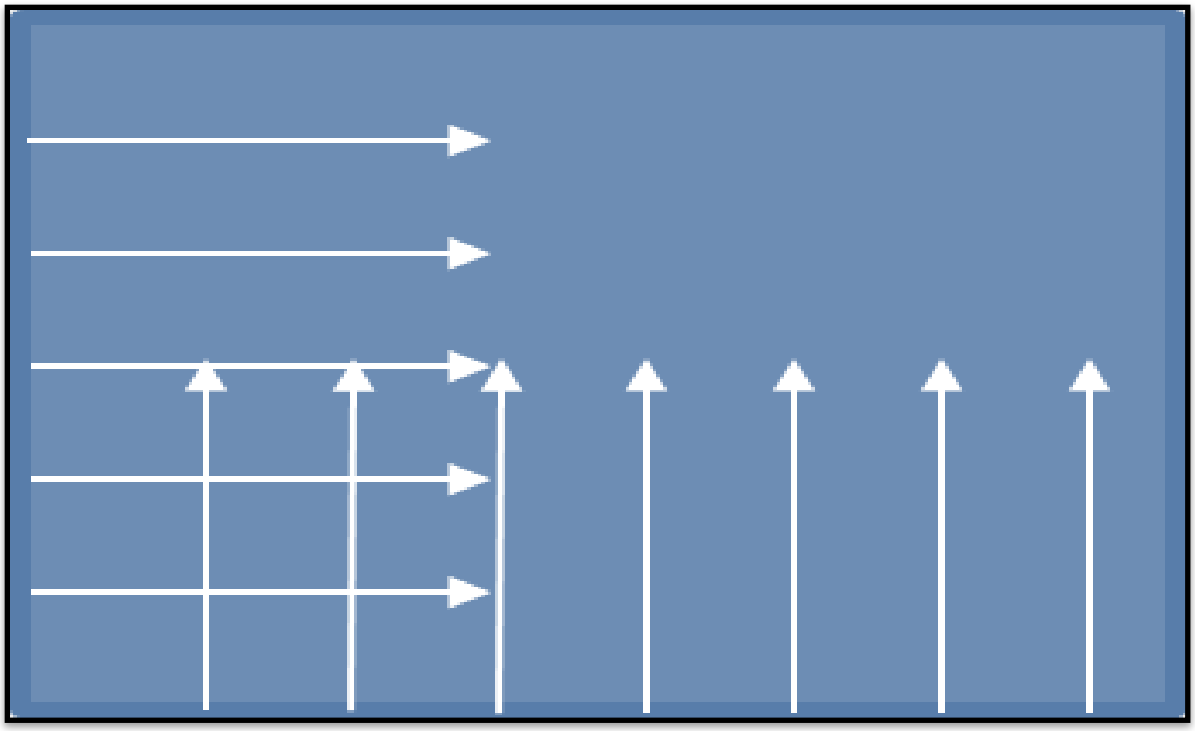

Figure 2-7 Multiple Passes

Practical Exercise
Flag off an area 50m by 50m. Place clues where searchers will have a more difficult time seeing them on the first sweep. Line up the team of searchers on one of the boundary lines. Assign roles to each of the searchers, team leader, navigator etc. Have team search entire search area. Upon completion of first sweep, have team line up on a boundary line 90º to first sweep. Have team search the area again. Upon completion of exercise debrief with all members.

Complexity of exercise can be modified by increasing the size of the search area or with the addition of more searchers and more clues.

2.2.2 Hasty Search

This method of searching, also known as sweep search, or an open grid search, is used when a search area must be covered quickly and by a minimum number of searchers. These searchers should be experienced and clue aware. The hasty team is used primarily when looking for a responsive person(s) or the person(s) is believed to be easily visible. The search areas should be divided up into smaller sections and clearly marked.

The team will normally consist of 3 persons; a team leader/navigator and 2 searchers. The team will line up at the base line and the starting points for each person should be flagged and tracks recorded with GPS (if available). It may be necessary for all 3 members to carry radios to ensure communication between members is maintained. Separation of searchers will be based upon desired thoroughness of search, terrain,

visibility, fatigue of searchers etc. The team will sweep the area, stopping to call to the missing or lost person(s) and waiting for possible responses. While making the sweep, team members should be looking up and down, backwards and side to side. The team leader/navigator must ensure that the team stays on their assigned bearing. If the team is out of sight of each other it may aid the searchers if the navigator lays out a hip chain as he/she travels or they follow the same compass bearing as the team leader. This will ensure that neither searcher will travel into the other searchers search area. Upon completion of the sweep the team leader will communicate with command post and all members will flag their exit points.

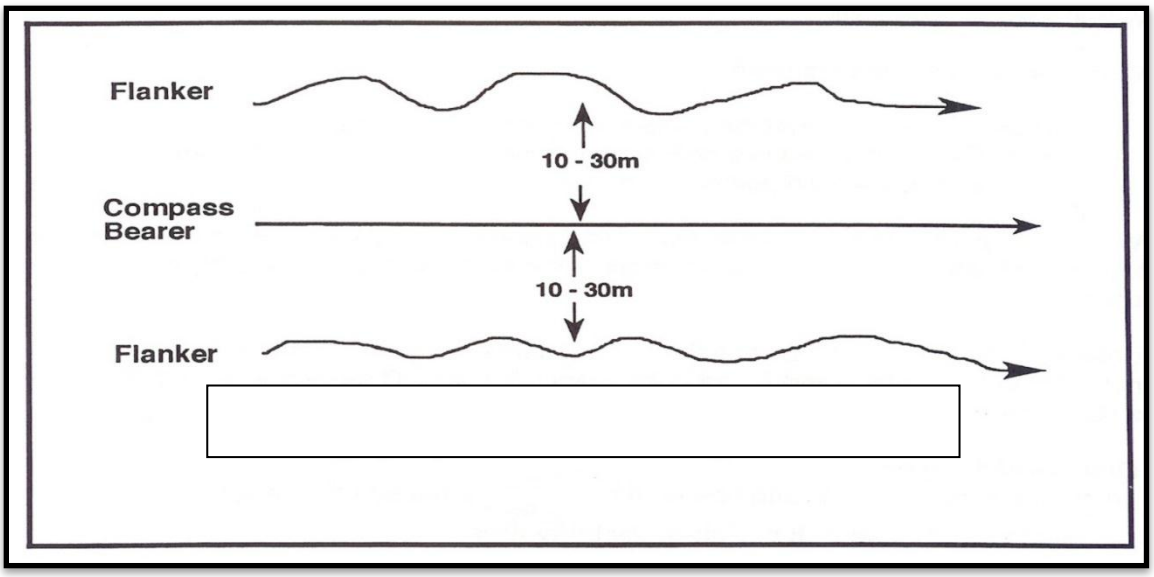

Figure 2-8 Hasty Search

Practical Exercise
Flag off an area 50m by 50m. Line up a team of searchers on one of the boundary lines. Ensure people know their roles and have the team search the flagged area. Upon completion debrief with team.

2.2.3 Track Crawl

The track crawl is a search pattern that usually consists of 3 to 5 searchers and is utilized when following a man-made feature (i.e. road, path, or trail). Starting from a marked baseline, searchers will line up and follow this man-made feature, or clue which indicates direction of travel of the missing or lost person(s) (*people and even animals tend to travel on the path of least resistance*). Spacing of the team members will be determined by the team leader based on terrain, lighting, searcher experience, searcher fatigue, possible clue etc.

The team may require multiple radios in case it becomes necessary for the team to split up. All members should track their sweeps using GPS (if available). The team will travel using the trail, road etc. as a boundary while looking up and down, backward and side to side for any clues. They should also call out to the missing or lost person(s). It is necessary to occasionally stop and listen for a response. Upon completion of the search area, the exits should be flagged and the team leader will communicate with command post and awaits further instructions.

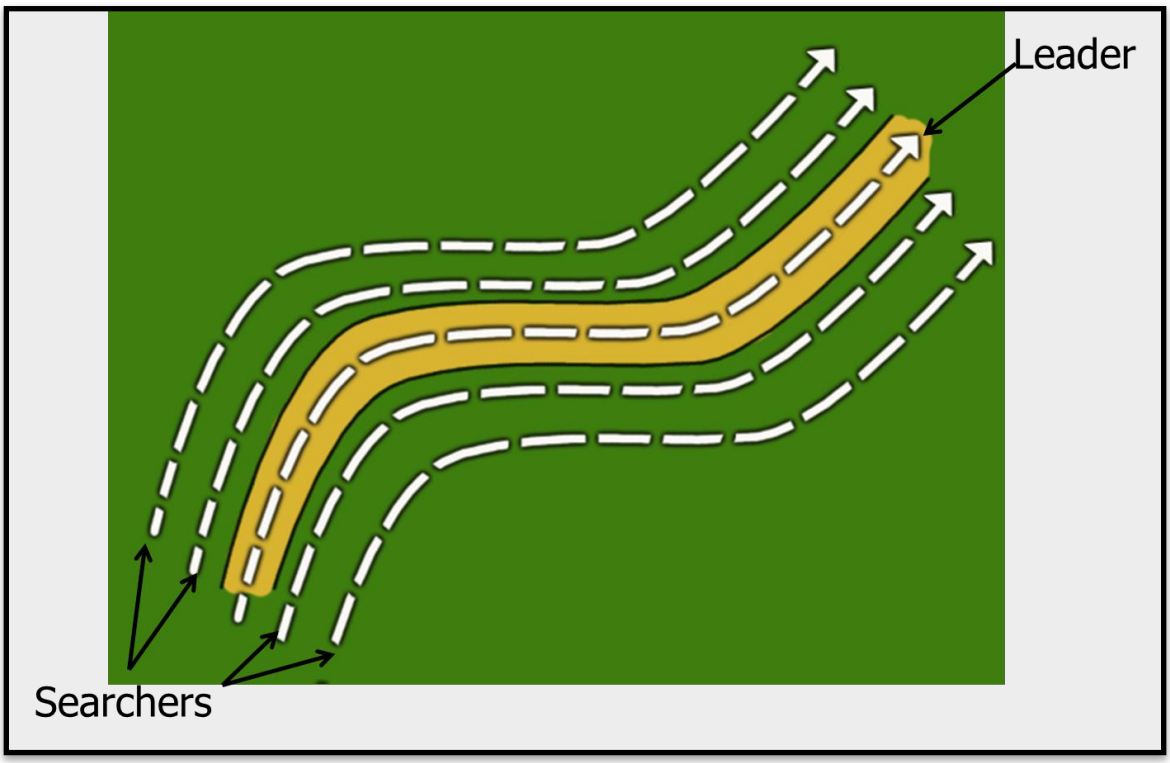

Figure 2-9 Track Crawl

Practical Exercise

Find a suitable road or trail. Flag starting position and conduct a track crawl 300m to 500m down the trail. Flag exit and report team findings. It is important that the searchers have hands on the equipment (i.e. flagging tape, hip chain, radios etc.). At the end of the exercise debrief with search team.

2.2.4 Binary Search

In order to comprehend binary search you must first understand the principals of *Sign Cutting*. Sign cutting is a procedure that uses tracking to save time. Trackers examine the Point Last Seen (PLS) or the Last Known Position (LKP) looking for tracks the missing or lost person(s) may have left.

When the tracker finds a signature track, it is carefully measured, examined and the track size and stride length are set on a tracking stick. One tracker will methodically follow the tracks while several other clue aware search team members will make sweeps to try and discover more sign ahead of the tracker. If a searcher discovers sign of the missing or lost person(s), they can then again leap frog other members ahead of them in the known direction of travel to try and cut the missing or lost person(s) off.

The search area can quickly be reduced in size by using this technique. This process will continue until the missing or lost person(s) is found or other search patterns/techniques commence. For more information on sign cutting, see Section ***2.12 Tracking***.

The binary search technique is the most efficient in terms of limited resources. It also utilizes sign cutting. From the LKP or PLS of the missing or lost person(s), clue conscious searchers make sweeps ahead through the probable search area trying to detect some clues that the missing or lost person(s) may be in the area (see ***Figure 2-10 Binary Search***). If a clue is detected, large areas can be eliminated from the search and other searchers can now leap frog ahead (points A and B) to try and intersect the missing or lost person(s). The leap frogging searchers may not intersect the subject but may find more clues which will again allow other searchers to leap frog ahead of them (points D and C). Searchers must remain focused during this process and remember not to look just for the missing or lost person(s), but also for any clues that may determine the direction of travel.

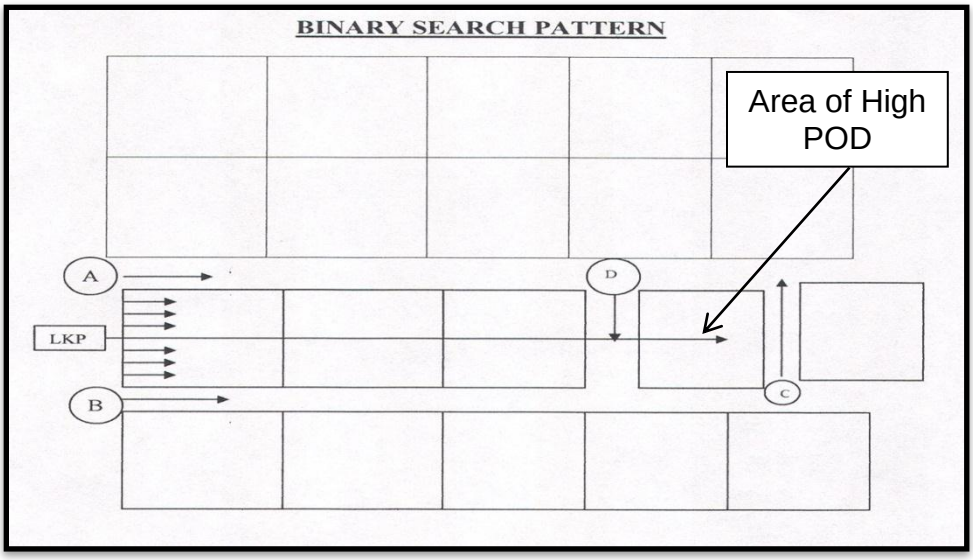

Figure 2-10 Binary Search

2.2.5 Contour Search

The contour search is a pattern that normally consists of 3 to 5 searchers. This pattern is very similar to the track crawl, while instead of using a road or path as a guide, searchers will follow distinguishable topographical features (i.e. shore line, base of a cliff, ravine).

Searchers will line up at 90º to the lay of the feature. Separation of searchers will be determined by terrain, lighting, searcher experience, searcher fatigue, possible clue etc. All members should track their sweeps using GPS (if available). The searcher closest to feature will use the feature as a guide and the remaining searchers will use the inner searcher as a guide.
Missing or lost person(s) will often use these well-defined features to travel on; as such, searchers should be extremely focused to ensure no clue is over looked. Searchers are to look up and down, side to side, backwards, call out to the missing or lost person(s) and stop frequently to listen for a response.
The outside searcher will flag a line for the next sweep (if required). Upon completion of the sweep, the exit is to be flagged and the team leader will contact the command post.

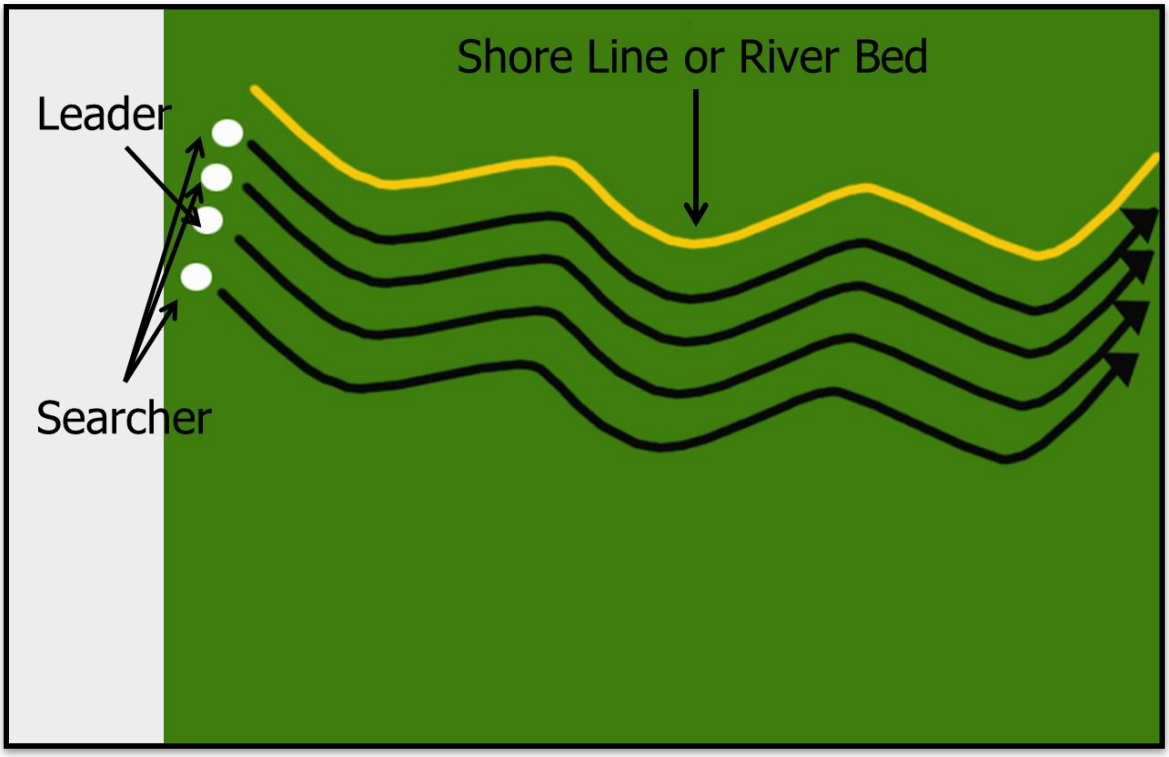

Figure 2-11 Contour Search

Practical Exercise
Find an area with a distinguishable topographical feature (lake shores work well) and have the team perform a contour search. Ensure that starting point, outside boundary and exit points are flagged. Ensure searchers look up and down, side to side, and back as well as calling out and stop occasionally to listen. Have searchers use all equipment

normally used on search (radios, GPS, hip chains etc.). Follow the team through this exercise evaluating and answering questions.
At the end of the exercise debrief with search team.

2.2.6 Perimeter Search

The purpose of performing a perimeter search is to determine if the missing or lost person(s) has left and/or re-entered the search area. There is no reason to search an area if there is no person in it.

The diameter of the search or containment area will be determined by the search manager and command post based on:

- Age
- Physical condition
- Weather
- Ailments
- Knowledge of the bush
- History
- Preparedness
- Number of hours passed
- Statistics, behavior and characteristics of missing or lost persons

Perimeter search teams usually consist of 3 experienced clue wise searchers one of which should be a tracker. There may be more than 1 team doing the perimeter search as confinement of the area should be done as quickly as possible.

The team will start at a designated location and record their sweep with GPS (if available). Hip chain works well to mark the perimeter of a search area because it is a solid line. Notes can be attached to a hip chain providing information to the missing or lost person(s) (i.e. directions to a way out). Flagging tape can also be attached to hip chain to make it more visible. Anything passing through the hip chain will cause it to break. A regular perimeter search and inspection of the hip chain will alert the searcher that something has either entered or left search area.
The navigator on the team will have to navigate the entire perimeter unless natural boundaries exists (lake or river shorelines, cliffs). The search team will have to remain extremely focused to find any clues. The team should also be very vocal, calling out to the missing or lost person(s) and stopping regularly to listen for responses.

Upon completion of the perimeter search and based on what the perimeter team reports, command post will determine whether or not the missing or lost person(s) may still be in the search area. On-going monitoring of the perimeter will continue for duration of search.

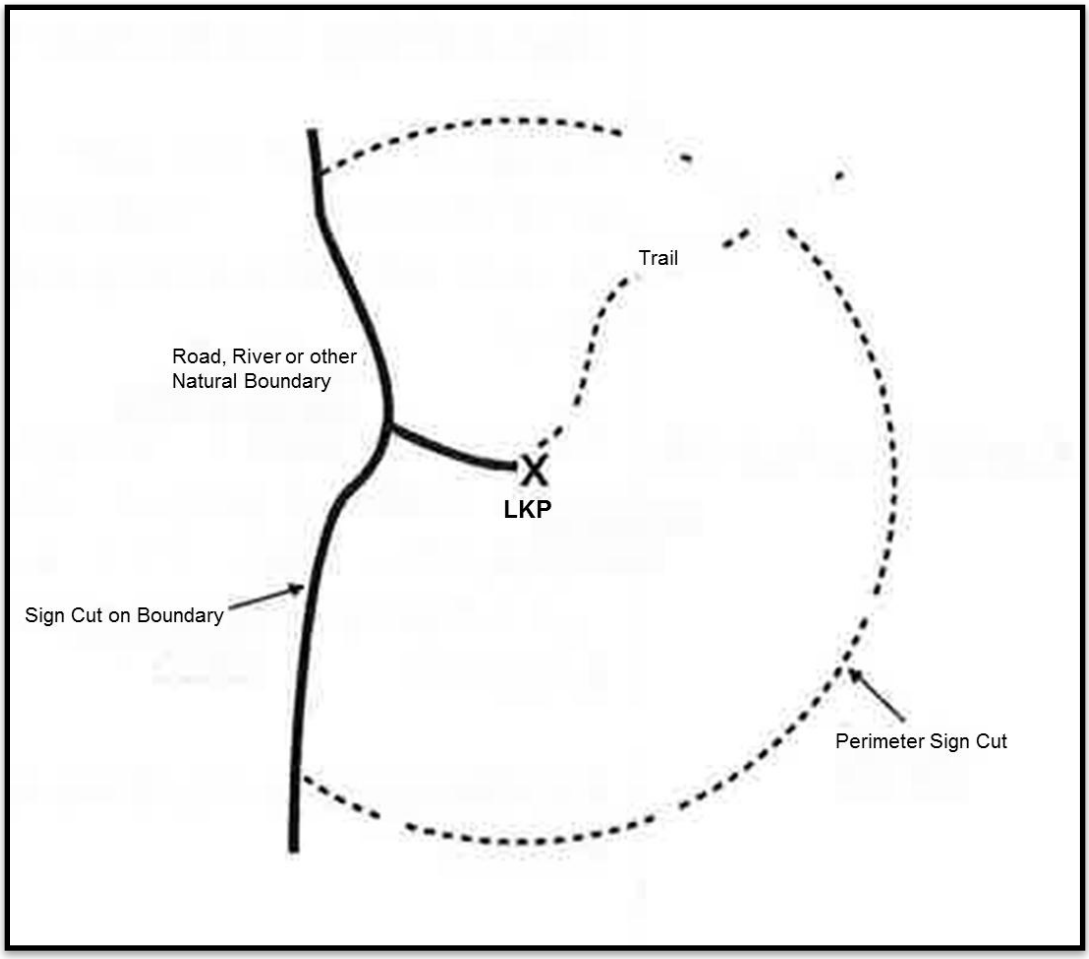

Figure 2-12 Perimeter Search

2.2.7 Purposeful Wandering

Purposeful wandering is a search pattern that can cover a large area in less time than a grid search. This pattern can use a little as 4 searchers and one team leader to as many searchers as you want, the more searchers the more area covered in one sweep.

The purpose around this search pattern is to allow the searcher to wander back and forth while moving forward following a bearing. Allowing the searcher to wander covers a larger area in a smaller amount of time. All searchers will be given the bearing to follow. The team leader will follow behind the line in order to maintain control of the searchers and to assist in the communication between searchers.

The distance between the searchers will be determined by a large number of factors, which could include terrain, time of day, season and vegetation. A typical spacing for this type of search pattern would have the searchers spaced 20m apart to start and allow them to go up to 30m apart. In addition to searching, this pattern can be used to get a realistic map of the area. Once they have completed the area, they can come together and produce a general map of the area as each searcher saw it. This map will be very useful for the search manager/command post, providing an up-to-date picture of

the area. The map also will be able to identify areas of interest that may require another search pattern or resources to clear, or hazard areas that may endanger the searcher's safety. Also, when team returns to command post, download tracks/waypoints from GPS.

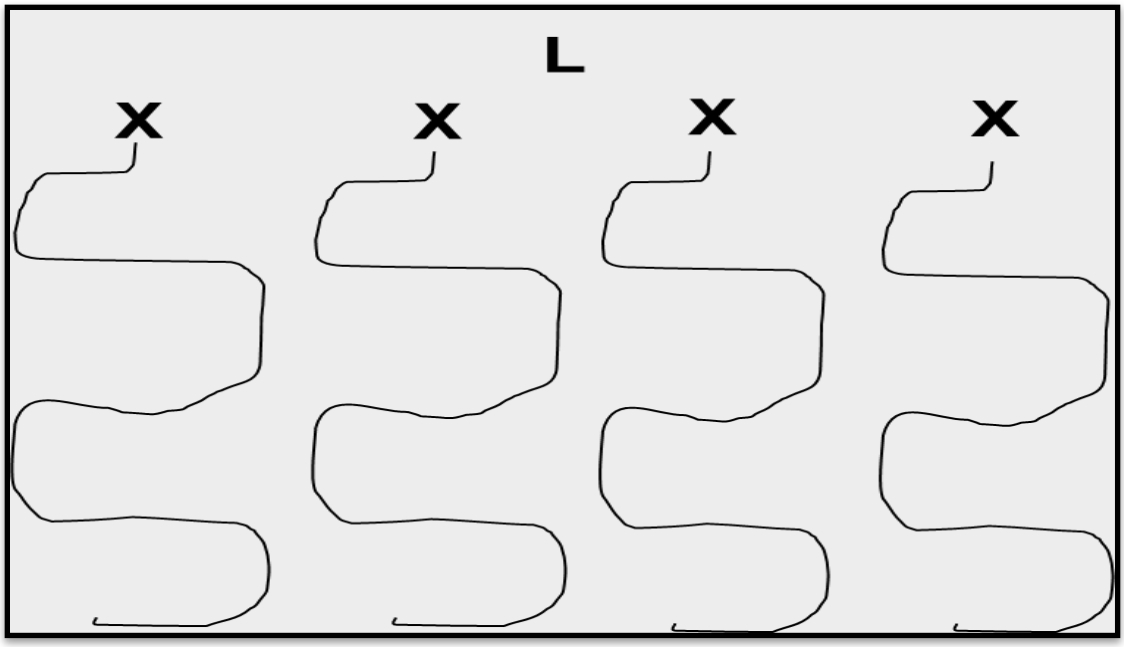

Figure 2-13 Purposeful Wandering

2.3 Attraction Methods

Attraction methods are designed to aid a conscious, mobile person find rescuers and safety. It is always easier and more efficient if the missing or lost person(s) finds their own way out, than sending in large numbers of searchers and resources to find the missing or lost person(s).

NOTE

Extreme care must be taken not to accidentally lead a missing or lost person(s) at night into a hazardous area where they could be seriously injured.

Attraction methods may include sight or sound techniques or a combination of the two, and may be used both during night or day operations. Attraction methods can be implemented with a minimum number of searchers.

2.3.1 Sound Attraction Methods

Anytime a search is being conducted (day or night) for a presumed conscious (responsive) person(s), searchers should be calling out to the missing or lost person(s). After calling out, silence should be observed for 10 seconds to allow the person(s) time to respond. If the weather is good, the missing or lost person(s) could be responsive for at least 72 hours. The longer the person(s) remains exposed to the elements, the weaker the response will be (so time is of the essence).

Sirens, car horns, air horns, bear bangers and whistles can all be heard for great distances and are great items to use for sound attraction.

NOTE

Ensure that your method of sound attraction is communicated to command post. This will allow other search teams to be aware of your attraction methods.

The sound being used should be used at regular intervals to attract the missing or lost person(s). The repetition of the sound will allow the person(s) to zero in on the sound and determine their direction of travel towards the rescuers.
Vehicles may patrol roads day and night using sound to attract missing or lost person(s). The vehicle will drive a predetermined distance (i.e. 100 meters) turn off the ignition, sound horn and listen for a response. This same technique can be applied to the use of mountain bikes, ATV's, snowmobiles, boats and canoes.

NOTE

Care must be taken when using ATV's and snowmobiles as they could destroy valuable clues.

Points to Remember

- Sound off and then remain quiet for 10 seconds, repeat process.
- If there is a response, try and determine bearing and contact command post.

2.3.2 Visual Attraction Methods

It is always simpler if you can have the missing or lost person(s) come to you than you find them. A combination of visual and sound attraction methods are the most effective.

If the lost person is hearing impaired, visual attraction method techniques will have to be used instead of sound. Any person(s), who is lost, will be trying to use their senses (sight and hearing) to find something familiar to aid them in finding a way out. This is why visual attraction techniques are used and are extremely effective. A search team may take a position on a higher elevation and maintain a fire. The smoke from the fire during the day is a good visual attraction.

The brightness of the fire at night can under the right circumstances be seen from great distances. Lighted beacons or signal flares are also very visual especially at night**.**

NOTE

Care must be taken when fires and/or flares are used as to not start a bushfire.

Vehicle headlights and spotlights are also good night visual attractions. A vehicle patrolling a perimeter or interior road at night may be seen by the missing or lost person(s). Searchers wear bright coloured uniforms (usually florescent/chartreuse green or hunter/blaze orange) while on the search, this allows them to be easily spotted by other searchers or by the missing or lost person(s).

Practical Exercise

Exercise to be conducted at night. Find a road that follows a ridge or rise of land. Start a fire. Have a group of searchers, starting at the fire, walk into the bush recording distance as they travel. Have the team stop when they can no longer see the fire and record the distance travelled. Put out the fire. Repeat this exercise utilizing a light beacon. Again repeat this same exercise for vehicle headlights and signal flares.

This exercise, while giving the searcher some insight into the value of some different visual attraction methods, also gives them an exercise in fire building and night navigation.

2.4 Confinement Methods

Confinement methods are designed to let searchers know if the missing or lost person(s) has left the search area, give some indication of where they left from and a direction of travel. There is absolutely no reason to waste manpower and energy searching an area that the person has left. Confinement of the search area should be implemented as quickly as possible, whether during daylight or darkness.

Confinement methods are implemented along the search perimeter to ensure the missing or lost person(s) does not leave the search area undetected. Confinement of the search area must be continuously monitored 24 hours a day once the perimeter has been established.

Some confinement methods include:

- Road Block
- Trail Block
- Camp Ins
- Look-Out Post
- Listening Post
- Hip Chain
- Track Trap

Several or all of these methods may be utilized on a search.

2.4.1 Road Block

Road blocks must be established and be identifiable (i.e. marked with pylons) on all roads leading in or out of the search area. Road blocks should be manned by well identified individuals with good speaking and listening skills. The person manning the road block may have the opportunity of informing the public entering the search area of a description of the missing or lost person(s) and what to do if they spot this person. This person must also stop and interview people leaving the search area. The missing or lost person(s) could easily be a passenger in any of the vehicles, or the people leaving the area may have seen the missing or lost person(s).

2.4.2 Trail Block

Trails or paths should be blocked. Missing or lost person(s) will normally take the path of least resistance. The trail blocks should be marked so the missing or lost person(s) can clearly recognize them. Notes can be left indicating the way out or wait here, help is on its way.

Regular patrols of the path or trail must take place. Patrollers on the path must carry a radio, remain focused and be clue aware. If the missing or lost person(s) traveled the trail and then left it at some point the searcher patrolling the trail should be able to recognize it and report to command post giving a location and direction of travel.

2.4.3 Camp-Ins

Camp-ins usually consists of a 2 or 3 person team. A camp site is set up to give the team some comfort as this camp may be in use for several days. The team will require essentials for an extended stay (food, water, bedding, etc.). Team members have the responsibility of maintaining a fire, using sound attraction, listening and watching 24 hours a day for the missing or lost person(s).

2.4.4 Look-out Post

If there are areas of higher elevation that overlook open areas, perimeter roads, shorelines etc., look-out posts should be established. A look-out post team usually consists of 2 or 3 persons. This team should set up a camp as they may be here for several days. The team will require essentials for an extended stay (food, water, bedding, etc.). If there is no danger of starting a forest fire then a fire should be kept going, the smoke during the day could attract the missing or lost person(s), while the light from the fire at night could also attract their attention. Sound attraction methods may also be used. The team will use binoculars to assist them in maintaining 24 hour surveillance. The team must maintain radio contact with command post. Should the missing or lost person be spotted, this information will be called in to command post so a team can be sent in to intercept.

2.4.5 Listening Post

Listening posts are very similar to look-out posts, except they don't have to be set up on a higher elevation of land. A team usually consists of 2 or 3 persons that must be prepared to spend several days in the bush. Again a camp should be set up to give the team some comfort and shelter from the environment. The team will be using sound techniques to try and attract the missing or lost person(s).

The team must remain focused on listening for any sound that the person may be making (i.e. breaking branches, splashing, calling out). This technique works better at night when sound travels much farther and the absence of surrounding noise make it easier to pick up and recognize.

This is also a better time for the missing or lost person(s) to pick up on sounds. The person(s) is usually not on the move at night and the darkness makes them a lot more aware of the sounds around them. Should the listening team hear anything they suspect could be the missing or lost person(s), they are to notify command post and use sound attraction techniques to try to attract the subject.

2.4.6 Hip Chain

Hip chains marking the search area boundaries can be set out with flagging tape to make them more visible. Notes containing a message to the missing or lost person(s) can also be attached to the hip chain at regular intervals.

Hip chains should be patrolled by 2 person search teams at regular intervals. The search team upon discovering a broken hip chain can determine what has caused the break, animal or human. If it is determined that a human broke the chain then the team will try and determine the direction of travel and report this information to command post. The team will likely be directed by command post try to track the missing or lost person(s).

2.4.7 Track Trap

Track traps are created by removing or brushing clean any tracks on roads, paths, trails, beaches, or areas with soft soil that will hold a track. The purpose of track traps is to have the missing or lost person(s) leave clear footprints behind if they pass through these areas.

Search team will inspect the track traps every few hours. Should you discover footprints, determine if the tracks belong to the missing or lost person(s). If the footprints are that of the missing or lost person(s), then direction of travel is established and this reported to command post. Command post will then issue instructions to team.

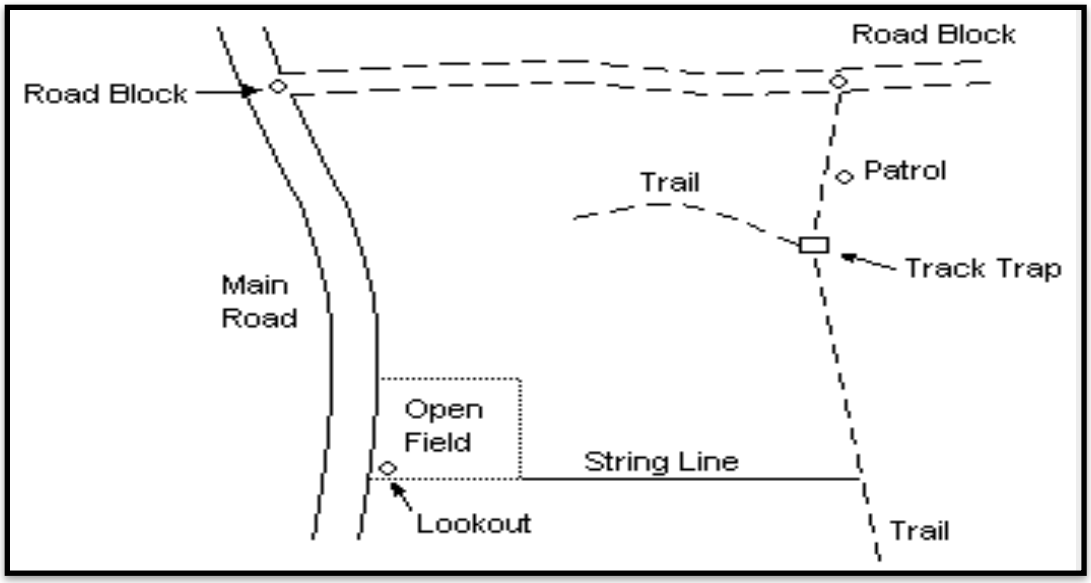

Figure 2-14 Confinement Methods

2.5 Staging Area

OBJECTIVES: To provide searchers an overview as to what happens at the staging area.

Elements and *need- to-know* information of a staging area:

- Staging areas may not necessarily be at the search location.
- Searchers will gather at an adequate area that can accommodate parking.
- Follow parking instructions given at staging area (staying clear of K9 vehicles).
- All searchers will sign in at the staging area.
- Searchers can assemble communication equipment, command post, shelters, portable washrooms and other team needs.
- Searchers will assemble their personal gear while awaiting instructions.
- Team leaders will get their tasking and assemble their assigned team.
- Briefings can take place at a designated quiet area within the staging area (see Section ***6.2.3 Briefing***).
- Roles may be assigned at this location.
- Team equipment can be distributed and checked as required.
- Searchers may rest in the staging area.
- This is the place that searchers should stay while awaiting instructions (a searcher should not approach nor enter the command post).

The searchers should now be ready for deployment or re-deployment.

Figure 2-15 Staging Area

2.6 Critical Distance / Separation

Critical Separation is defined as the spacing between two searchers such that an object placed midway between them is at the limit of visibility of both of them. *Critical Distance* is defined as the distance from a searcher to an object that is at the limit of that searcher's visibility.

Therefore for a particular object in a particular location - *Critical Separation = 2 x Critical Distance*

Critical Distance is the distance a searcher can effectively search. If the critical distance is determined to be 2m, then the searcher will be responsible to search 2m in all directions.

2.6.1 Technique to Determine the Critical Distance

Choose an object of similar size and colour as object being searched for.
Have 2 searchers walk away from the object in opposite directions until the object is just out of sight. The searchers will then walk back towards the object until it is visible to both searchers (distances are recorded). Searchers then repeat the same exercise at 90º to the original exercise and record the distances. The average of the four distances is the critical distance. Critical distances are unique to each individual searcher.

The reason for determining critical distance is that the team leader must know prior to beginning a search, that distance that the searchers must be separated by and maintained (critical separation) in order to effectively search an area. Two searchers

searching side by side are separated by the critical separation. If a clue is placed half way between them, both searchers should be able to spot the clue.

2.6.2 Some Factors Affecting Critical Distance

Types of ground cover - if the foliage is thick or grass is high, critical distance will be less. If the search area is an open field with short grass, critical distance would likely be greater. When there is less light or there is poor visibility the critical distance is usually reduced. There are many more factors that will affect critical distance, size of clues, visibility of clues, suspected unresponsive person, hiding person, and the factors go on and on.

A study has shown that a search done at ½ the critical distance had a POD of 75%, while a search done at 2x the critical distance had a POD of only 25%.

NOTE

Remember the distance that a searcher can effectively search is called the critical distance. The distance between searchers who are maintaining the critical distance is called critical separation.

Practical Exercise

Have searchers place objects of different sizes and colours in different environments (i.e. a field, in the bush, on a steep grade of land) at different times of the day and calculate the critical separation.

2.7 Night Search

There are times when a SAR team must be deployed to search for a missing or lost person(s) at night. Typically it would be when the subject profile or weather conditions demand an immediate and full response.

A night search poses a few more challenges than conducting a search during the day. Visibility is greatly reduced, the terrain becomes more difficult to navigate, the search pace is slower. Co-ordination of teams at night will be more difficult.
Although more complicated search patterns may be impractical to conduct at night, initial response teams can operate in the dark and most types of confinement procedure can also be applied at night.

However, there are distinct advantages to searching at night and include the following:

- The subject is usually stationary and more aware of sound.
- The amount of time during which the search is conducted is expanded.
- Sounds and smells are easier to detect.
- Light from beacon flares and flashlights will be more visible.
- The absence of ambient noise from daytime activities makes sound sweeps more effective.

- Tracks illuminated at a low angle by a flashlight show up more readily than when illuminated by the overhead sun.
- Radio communication is clearer at night.

Some form of light is required for a night time search. Hand-held flashlights are satisfactory, but headlamps allow for hands-free operation and are the most effective. All searchers must be equipped with a good light source and carry extra batteries and light bulbs (not so much the case with LEDS).

NOTE

It is important that searchers do not allow their lights to shine in other searcher's direction as each time this occurs it takes several minutes to restore night vision. Another concern about searching at night is the danger it can represent to the searcher. Areas that cannot be searched safely should be left until daybreak. Cliff areas and areas where old mine shafts exist, are places to avoid at night and should be searched during day light hours.

Figure 2-16 Night Search

2.8 Team Protocols

Protocol is a diplomatic and political term that refers to appropriate behavior and rules of conduct for a particular situation or event. Protocol can also be a more sophisticated word used to denote appropriate actions or rules in business. Protocol can also be used as a verb, meaning, *to draw up or issue a protocol*, but is most often used to refer to rules or conventions. Below is a list of suggested team protocols that should be developed (if required) by SAR teams.

Suggested Protocol List:

- Attendance
- ATV, snowmobiles and other search vehicles
- Call-out procedures, rendezvous points, gear and equipment
- Camera use
- Carry the line/hold the line
- Cell phone use
- Certification/recertification training
- Clue detection
- Code of conduct / Code of ethics / Professionalism
- Command post
- Community service – fundraising
- Compass (declination)
- Confidentiality and privacy
- Critical stress
- Dress/clothing
- Equipment - personal and team
- First aid/medical
- Flagging
- GPS
- Helicopters
- Injured member
- Missing or lost person(s) - What to do when found: deceased, combative, despondent, unconscious
- Managing non-trained volunteers and subject's family
- Maps
- Media and media relations
- Muster area/staging area
- OSARVA members transferring between teams
- OSARVA members of other teams in the area participating in search
- Personal relations
- Radio - care and handling, voice procedures, codes
- Safety - including personal protective equipment
- Scribing - searcher field notes, command post record keeping
- Sign-in/Sign-out
- Social media
- Team briefing/debriefing
- Team bylaws

- Team composition
- Team leaders – positions
- Tracking
- Training documentation
- WSIB

2.9 Clue Awareness

OBJECTIVE: To inform search team members of the importance to always be looking and scanning for the clues that may or may not be easily seen.

NOTE

"It is just as important to find nothing, as it is important to find something."

One USA estimate is that a person leaves at least 1250 pieces of evidence or clues in every kilometre walked. We may see these pieces of evidence but, unless we're trained, we may not identify them as clues. Trained searchers can examine these clues and possibly determine a direction of travel.

There are 3 senses that we must use to be successful searchers and to enhance our clue awareness:

- *Sight (Looking)* – it sounds like such an easy term and word to follow, but the truth is, looking is much more difficult than it seems. When people look, they typically scan, from left to right, the view ahead of them and their brain will fill in the gaps if something is missed. If we are familiar with our surroundings, this is more common than not. We do not take the time to really look at what is in front of us. We are in a hurry; we become complacent with our surroundings and do not challenge ourselves to be aware of what we are observing. Think of how many times someone will drive to and from work every day and are unaware of the environmental changes occurring around them. We must train ourselves to be cognizant of our daily surroundings.

  We can start by scanning or looking from *right to the left*. The reason for this is we have been trained from a very early age when reading, to read from the left to the right, to write from the left to the right. By looking the opposite way, you are more likely to force your brain to take note of what you are looking at. This is something that must be practiced until it becomes second nature. When on a search, it is important to be aware of items or clues that may not be natural to the surrounding area. The searcher has to be able to see the cigarette butt or the gum wrapper that the missing or lost person(s) may have dropped or discarded along their path. The searcher should be able to see a disturbance in vegetation that will lead to the direction of travel by the lost person. This may come by way of bent foliage, pushed aside brush, marks left in the ground (see Section ***2.12 Tracking*** for further information). Again, this is something that should be practiced in a controlled environment to build the searcher's confidence level. Of

course, the time of day at which a search or training is being carried out, will provide a challenge and change how things are seen.

- *Hearing* – is an extremely useful sense that should be utilized as much as possible by the search team as sound at night becomes much clearer. This is where sound sweeps are beneficial (see Section ***2.3.1 Sound Attraction***), this way the sound will carry further and should the missing or lost person(s) respond, there is a higher probability that they will be heard as a result. This is not to say that the sound sweep method should only be used at night, only that sound travels better at night as there are fewer interferences. During the search, noise discipline should be strictly followed as auditory distress signals or calls for help may go unheard.

- *Smell* – part of the search and being aware of clues is being aware of what it is that you smell. Some people have a better sense of smell than others; typically women are better at this than men. Searchers may be able to smell a campfire, or cigarette smoke which in its self could be a clue to the missing or lost person(s). When searching at night, scents travel farther and are more easily detected.

Environmental Factors - such as, but not limited to, wind, rain, fog, sleet, snow, sound (rushing river) are often outside factors that we cannot control, but must adapt to while on a search. ***Chapter 4 Environment*** makes reference to many of these factors. Training in and around these factors will reinforce the searchers abilities as they will become accustomed to these distractions.

Human Factors – searchers must be in the right frame of mind to be an effective searcher. With this being said, we are all human and life throws us distractions all the time, so all we can do is our very best. Conditions such as mental fatigue, physical fatigue, personal injury, shock, and many more are personal factors that will affect how we search. It is important to be aware of these things and a searcher should ask themselves, “Am I ready to be in the field?” There is no shame in pulling aside your team leader and letting them know that you cannot participate in a search, it’s better to be aware of something sooner rather than later.

Practical Exercise
These exercises can be run at any time of the day or night, in any weather.

Setup: You will require about 30 to 45 minutes of set up. Pick your station operators ahead of time, possibly a day or so ahead and have them read the exercise. Set up a time to meet before the rest of the team shows up for their scheduled training. Radios to be assigned to each station operator. Leave some sort of flagging or location indicator as to where the stations are. Station operators will be responsible for the following:

- Provide a map to the participating teams.
- The placement of clues in a forward path of travel and a return path.
- Briefly explain the purpose of today’s exercise.

- Divide the team into groups of 2 or 3. Assign them to each station and take them to their starting points.
- When groups have completed their assigned task, have them move in a sequential fashion – for example: move from station 1 to station 2, move from station 2 to station 3 and so on.
- When all the teams have completed all stations, have each group return to your staging area.
- Once all members have returned to the staging area, carry out an overall debrief (find out what was liked, not liked, get feedback).

Station 1 Exercise
Objective: Positive reinforcement of clue detection abilities through a very high percentage of detection.

Set up: Station operator to run this station:
- In a distance of 15m place several items on the ground.
- Have a start point and a finish point.
- Max time for task is 5 minutes per participant.

Concept: Within the time specified, have participants navigate this task while searching for various *unknown items*. Participants who are awaiting their turn are to be facing the opposite direction.

Participants have 5 minutes to search and try to find all items. Once this task has been completed, participants are to report to the station operator with their findings.

Station 2 Exercise
Objective: To aid participants in the skills of *sign* detection.

Setup: Station operator to have a start and end point. Walk from one point to the other, either on the clear terrain or through the taller foliage. The taller foliage is preferable as the direction of travel is detectable.

Concept: To aid in the detection of sign – the direction of travel. The angle of light, time of day and one's fatigue are all factors in *sign* detection.

As we move across the ground, we leave trace. This is common with humans and animals, though in some cases, animals are more difficult to detect. By detecting the missing or lost person(s) path of travel (direction of travel), the search area can be significantly reduced.

While this exercise will not provide all the tools that are required to become a proficient tracker, this will provide an insight into tracking. To attain a level of proficiency, many hours of tracking are required, far more than what is taught through the basic GSAR course.

Things to look for:

- *Clues* are objects, information, or some form of evidence that helps locate a missing person.
- *Sign* is the evidence of a person's passage. This can be visible tracks, compressed ground, moisture knocked off of grass, damaged leaves, dirt transferred onto plants or many other things.
- *Sign Cutting* is finding a track or sign using human nature, the terrain and environment to get ahead of the person(s) you are tracking.
- *Track or print* is the impression left in the ground as a subject passed over an area. A signature print is a footprint displaying characteristics that make it unmistakably identifiable.
- *Tracking* is the step by step following of a person.
- *Track Trap* is an area that shows tracks well (see Section ***2.4.7 Track Trap***).
- *Tracking Team,* usually a team of 3, each with specific functions, following a line of sign.

NOTE

Even though GSAR trained personnel are not as sign/track aware as a trained tracker, they should still always be looking for sign anytime they are traveling down a trail, road, or through the bush.

Station 3 Exercise
Objective: To aid participants in the ability of seeing what nature has not created.

Stationary viewing (sit and standing)
Setup: Station operator to place objects within viewing distance (max 3m to 5m) from fixed location. This is to be done on an individual basis. Give your participant 5 minutes to identify placed items.

Concept: To aid in the detection of items that are not natural. The angle of light, time of day and one's fatigue are all factors this exercise.

Nature has a way of letting you know when there is something that does not belong. Nature does not have straight lines, is not square and does not have exceptionally shiny objects. You have to be able to read your surroundings, see things that are there, but hidden, see things that do not belong. Look to see what doesn't belong.

Station 4 Exercise
Objective: Positive reinforcement through a very high percentage of detection.

Set up: Station operators to run this station.

- In a distance of 10m, place the items at eye level.
- Have a start point and a finish point.
- Max time for task is 5 minutes per participant.

Concept: Within the timeframe specified, have participants navigate this task while searching for various *unknown items*. Participants who are awaiting their turn are to be facing the opposite direction.
Participants are to take as much time within the allotted timeframe, search and try to successfully detect items which are out of place.
Once this task has been completed, participants are to report to the station operator with their findings.

2.10 Cognitive Vision

OBJECTIVE: Provide searcher with awareness on how cognitive vision can enhance their ability to search.

Cognitive is defined as: relating to, being, or involving conscious intellectual activity (as thinking, reasoning or remembering).

Cognitive Vision - Is the ability to see objects, capture all of those images, interpret and recognize those images for what they are, and be able to retain that information. We all believe that we have these abilities. Unfortunately, *cognitive impairment* is more common. We, in fact, do not see everything because of the distractions around us. We must work to develop methods which help at improving our cognitive vision skills!

All of our senses are affected by a variety of external stimuli (distractions, environmental change) and just as susceptible to dangers from within (fatigue, injury, illness, emotions).

A search is a controlled, technical, ever changing and dangerous process, thus adding to the difficulty of maintaining a high level of *cognition*.

2.10.1 Vision – The Eyes

Our sight is restricted by:

- Anything less than 20/20 vision (needing corrective lenses, being colour blind, injuries to eyes, fatigue).
- Less than perfect viewing conditions (too much or too little light, shadows, weather).
- Poor line of sight (foliage, barriers, other searchers, clothing).
- By a variety of simple distractions (nearby movement, sounds, the unexpected).

These are sometimes described as *Cognitive Errors* and affects how we interpret visual information. Searchers must continue to re-focus and establish their personal optical distance.

Everyone’s eyesight is different. Everyone focuses differently. The fact that most people have a dominant eye affects how we scan an area effectively. Searchers must test and confirm their individual optical search zone (their personal critical distance). The eyes need fresh images to focus in on. Sweeping eye scans will give you a snapshot perhaps

of the start of your sweep and the last vision captured, but the brain tends to fill in the middle as a blend of both and will miss important images in-between. Even the colours of objects can be misinterpreted and often blended with the colours of nearby objects.

A Lakehead University study asked the question, “Why don’t others see things my way?” Their studies indicated that s*can paths* from eye tracking equipment are useful for analyzing cognitive intent, interest and dominant items. A person’s gender, age, behaviour and well-being of the individual, all influence eye-tracking response times. The effect of stress on vision has been well documented.

Sight, as one of our primary senses, we must visualize what we cannot hear, touch, smell, or taste. But our eyesight is not perfect since it relies on so many outside influences to function at an optimum level. Not having 20/20 vision (requiring corrective lenses), effect of sun, shade, blocked view, injuries and fatigue. Even things designed to assist with sight may cause difficulties in seeing properly (bifocals, sun glasses, protective eyewear and caps).

2.10.2 Analysis – The Brain

The brain fills in the blanks on information transmitted from the visual sensors (the eyes). The brain requires accurate information which will allow it to compare and decide which images are important and should be noted. During a search, the brain relies on a visual history (an archival memory) of an area in order to determine what is new or different. Training and practicing search techniques in a variety of search conditions adds to one’s visual history.

The brain is task oriented. During a briefing, broad statements such as “search for the missing or lost person(s)” may encourage the brain to daydream rather than focus. A better process may be to assign smaller, more specific tasks, with statements such as: “Look for disturbances, footprints, items that don’t belong, look for evidence to indicate that someone or something has been in the area”. If a searcher is looking for a very specific object, then a picture of the object (or a similar object) is important so the searcher can imagine what it would look like on the ground or in the search area. The brain does not register every image transmitted optically and many objects appear to go unnoticed. Training is the key to developing more effective search techniques. After a training exercise, participants can’t believe what they had missed while searching an area. The obvious become visible again.

It is important for searchers to understand and believe that the relationship between what the eyes *see* and what the mind *observes* are quite different. A famous illusionist recently said “the more you concentrate, the less you see”. Perhaps it is simple misdirection, but people have been entertained for centuries by the slight-of-hand and the knowledge of an illusionist when it comes to tricking the audience. There are many examples of how this is done. This common cognitive error*, attention blindness*, can easily happen during a search if proper search techniques are not being used.

Our brain is also distracted by our other senses (hearing, touch, smell, taste) and is temporarily distracted by the actual function of the brain itself (problem solving). The genuine concern a searcher has for the well-being of the missing or lost person(s) is a *distraction* in itself.

All things affect the functioning level of the human brain.

2.10.3 Knowing What to Look For

Your briefing will include a description of the missing or lost person(s) along with items which that person(s) may be carrying with them. It will also remind searchers to look for items that do not belong in that environment and to look for evidence to indicate that someone or something has been in the area. Be clear on what these possible clues/objects might look like and how they may appear in the area (and under similar conditions) where the search is being conducted. Even the missing or lost person(s) themselves, if they are on the ground, make a very small target. Place that person in a wooded area, in long grass or taking refuge from the elements, and it will make our jobs as searchers even more difficult.

2.10.4 The Realization - We Can Always Improve Cognitive Vision

While we are alert, our minds are being bombarded with visual information. Somehow we have to be able to cope with it all. We deceive ourselves that we are consciously aware of everything that is going on around us, but this is not the case. We can only appraise the overall visual scene and (in cooperation with our vision and mental functions) elect which element of the visual scene to attend to at any one time.

Some people have *photographic* memories – they are able to retain what they read or see. This is a developed skill. Others are better at remembering a specific event that they observed. Police agencies train their officers to pay more attention to certain details that are more important in their line of work. These skills are enhanced through ongoing training.

However, most of us are challenged at perfection. There are too many elements that keep us from developing our cognitive skills. Again, the solution is to become better and try to eliminate the barriers that both nature and our own shortcomings put before us. We can establish training programs that allow us to get better at what we do.

2.10.5 Training Techniques

- Know what *normal* is – study the environment in which you typically search.
- Work as a team – set a good pace that suits everyone.
- Use trained *observers* during training to evaluate search techniques.
- Learn what distracts members of a search team as they proceed.
- Be critical (this is important) – correct weaknesses in search techniques.
- Practice, practice, practice.

Practical Exercises
From a fixed location or while walking down a trail, have participants view a normal wooded area and point out anything out of the ordinary (litter, broken branches, animal tracks, etc.).

From a fixed location or while walking down a trail, have participants view an area where objects have been placed in full view and record what they see (footprints, overturned leaves, broken branches, several objects that don't belong including objects that traditionally get left behind by a missing or lost person(s) such as wrappers, containers, clothing, cigarettes). Place things in such a way that will give searchers a sense of how these objects may appear in a real search (half covered, next to other more prominent objects, only seen from a different vantage point/angle).

Create a well-marked intersecting track for a training team to find.

Conduct Search and Rescue Exercises (SAREX) or mock searches to train your volunteers. (Use two members to act as missing or lost persons, leaving normal clues) and conduct a mock search following the clues left behind.

Use tracking techniques to help train your volunteers (see Section ***2.12 Tracking***). Test your tracking skills – make a footprint, step back and examine. Step on a plant, examine the change. Walk through an area of taller grass or brush; go back to your starting point to view your track.

Practice by changing your line of sight, various angles, perspective, reflection, and focus. Notice the change by simply viewing objects from a standing position and then by crouching.

NOTE

At the end of any exercise, missed objects should be pointed out to the participants, and they should be given the opportunity to understand why the object had not been detected.

2.11 Evidence / Clue Handling

OBJECTIVE: Bring awareness to searchers on evidence and/or clue handling.

Locard's Principal states "every contact leaves a trace and takes a trace with it".

Evidence and clue handling should be carried out in accordance with the individual search team's procedures and protocols. These procedures/protocols should be developed with the co-operation of the police service of jurisdiction. Components of evidence and clue handling should be taught both in the classroom and on field training exercises.

All evidence/clues should never be touched or moved unless you are instructed to by a member of the police service or command post. Once a clue has been located, the

search line should be stopped from moving forward and notify the team leader. Stopping the forward movement of the search line will protect any further contamination of a potential crime scene. All evidence/clues should be treated as a crime scene until the police service or command post has made a decision regarding the evidence/clues.

The searchers may be instructed to mark it in their notebook and collect it, wait for a member of the police service to attend the evidence/ clues for further investigation or disregard it. Searchers should stay in the location of the clue unless it would endanger the safety of the searcher at which time the searcher would move to a location of safety. From this location the searcher can wait for further instructions.

Searchers should carry some kind of marker (tent peg, flagging tape) for the purpose of marking their position. This helps in determining where every searcher was in relation to the evidence/ clues. When the searcher needs to move, a marker will be placed and the searcher should walk backwards trying to follow their footfalls to minimize contamination.

Searchers should never leave anything behind. If for any reason the searcher happens to inadvertently touch, step on or disturb evidence/clues, the team leader and police service should be informed as to what happened.

Another key point for evidence/clues handling is that all searchers should carry a notebook to record everything that happens during a search operation. The searcher will need to document everything in the notebook in order to recall what happened on that day. These notes could be used in a court of law. It is very important to document only on what you observe. In these notes, one should include date, time, weather, vegetation, terrain, members of the search line, where in the line the searcher was, description of the item, draw a map of the area etc. There is no limit on how much information should be recorded. If the search team is instructed to collect the evidence/clues, the search team will follow the instructions given by the police service and/or command post on how they want the item(s) collected.

Practical Exercise

The exercises for clue detection and handling should be set-up in a way to test all aspects of clue detection, recording and collection. A searcher must learn to search in all directions including above, over, under or inside. Basically the searcher will learn to look up, down, left, right, and behind them. Clue detection is a learned skill that with practice will get better and a searcher will become more efficient at it.

Training should take place in all types of weather, seasons, terrain and vegetation. Training should also use a wide variety and size of clues. Examples of some clues are bottle caps, bullet casings, clothing, footprints, broken vegetation, cigarette butts etc. Every training exercise should have the easy to find clues and the clues that may be missed because of size or location of the clue. Searchers need to be successful and also need to fail to some degree in order to get better and learn from mistakes. In all

training exercises the protocols of the search team should be practiced. The more a skill is practiced the more it will become second nature.

Clues for the training exercises should be placed out prior to any exercise. Clues could be placed out weeks, days or hours in advance. If the training is to be based on a missing person who would have been missing for weeks, the clues if possible could be placed out weeks in advance. One thing to consider is that clues placed out in public areas have the chance of being picked up by a member of the public or moved from the original location. If a team has private land areas to use, clues should be protected.

2.12 Tracking

OBJECTIVE: For the ground searcher, tracking is a specialty skill that requires countless hours of training in all conditions (i.e. weather, terrain). Skills required by the searcher are the awareness of *track* and *sign* that show someone or something has passed through the area. While this introduction to tracking will not serve as adequate training to become a certified tracker, it is very important for a member to understand the basics of track identification.

Tracking is a skill that enables one to see what is typically not seen and be able to see clues that upon quick inspection seem to not be there (*to see the unseen*). It is also a valuable skill that can greatly reduce the search area by determining the direction of travel based on *track/clues* found of the missing or lost person(s).

Track Terminology:

- *Clues* - are objects, information, or some form of evidence that helps locate a missing/lost person.
- *Sign* – is evidence of a person's travel. It includes but is not limited to visible tracks, broken or compressed vegetation; scuff marks on rocks, moisture knocked off grass, dirt transferred onto plants, to name a few and can provide searcher with person's direction of travel.
- *Sign cutting* - is finding the track or sign using human nature, the terrain and environment, to get ahead of the person(s) you are tracking.
- *Shine* – is a type of track left behind by the flattening of vegetation or another surface leaving behind no print design. The track can only be seen by the way the sun or another light source reflects off the flattened surface.
- *Track or print* – is a series of marks that indicate someone or something has passed by leaving tracks or prints.
- *Tracking* – is a step by step process of following the subject or confirming that the subject has not passed through the area.
- *Track trap* – is natural or man-made terrain or objects which would redirect or provide a confirmed track left by the subject.
- *Track team* - a team normally comprised of 3 members whose function is to follow the track.

Common tracking tools:

- *Pen/pencil and paper* – recording information relevant to the track.

- *Measuring tape* – utilized to record the dimensions of the *signature print*.
- *Tracking stick* – a tool used to easily detect the next print along the track (see ***Figure 2-17 Tracking Stick***).
- *Flagging tape* – used to mark and protect a clue.
- *Flashlight/head lamp* – used to enhance a track with shadows, when tracking at night or when a light source is required.

Basic skills that assist a search team are recognition of *sign* such as footprints, or items left on the trail. This would provide information that the subject they are looking for has travelled along this same route. The usage of track traps and cutting sign are useful tools in order to locate the missing or lost subject.

Once a track has been located, it should be preserved, protected, recorded to provide a description for use by the command post.

NOTE

Never touch or disturb a print or track found, as it is a clue and could be a piece of valuable evidence.

A description of the track/print should be recorded for later reference. Measurements should be taken and attention should be paid to the type or characteristics of the print. Questions that could be asked are:

- Is this a running shoe or a boot?
- Is this the right or left foot?
- Is there anything unique to this print?
- Are there worn spots?
- What are the designs within the print?
- What is the distance from the toe of the first track to the heel of the second track? (Some prefer the centre of the second – both acceptable measurements).
- Does it look like the subject is limping (which could indicate injury)?

With this print identified and recorded, the use of track traps and confirming the direction of travel is easier. This is an aid to sign cutting.

What do you look for? Clues come in many forms, such as a visible pathway through grass covered in dew (known as shine) or footprints along a gravel roadway or through a sandy area. Upon closer detection, footprints can be visible by way of rocks being moved in a dry area, leaving a wet spot. Disturbances could indicate direction of travel. While tracking, it is important to continue to look up and ahead. Many times, a positive print may be seen a few yards ahead allowing your team to move more rapidly to the next point. It is important to be aware of other visual clues in the path of the track or within the vicinity of your tracking team.

NOTE

It is also important not to walk on the track that is being followed in case the track is lost and you have to go back to the last track identified.

The tracking team is normally comprised of 3 members, one point person – the lead, and two flankers. Everyone will rotate positions to keep from tiring. The point person will focus on what is ahead of the team, while the flankers (just behind the point person) will examine what is to the left and right of the point person. This is important so other clues may be found, such as an intersecting sign or track. It is vital that the team be able to communicate with one another, remain positive and focused on the assigned task.

Using track traps is a helpful tool that can be used by both the search and tracking teams. Track traps may include but are not limited to, river and stream beds, cliffs, dirt roads, sand pits, bridges, swamps and mud holes to name a few. By examining your terrain, you can use the process of elimination and probability as to the direction of your subject. For example, you are on the track of your subject, you come across a mud puddle on the trail, there is a positive indentation in the soft ground to the side of the puddle – subject's direction of travel confirmed.

Determining the age of a track is also useful. New tracks have not been weathered, have not been damaged by the wind or rain and have not dried out and cracked. A fresh track will often be a sharp imprint – provided the ground is such to allow that. It is difficult for a sharp impression to be found on pavement, but at the same time, there may be dirt transfer left in a specific pattern which will show that someone has recently travelled through the area. If a track is visible with vegetation growing in it and the outline has smeared or blurred, then there is a good chance that this print is old and not relevant.

The best time to track for sign, such as footprints, is during the night; otherwise it is any time where the most shadows can be cast. At night, one can control the angle of their headlamp. By using a low intensity light, the effects on night vision will be greatly reduced. The worst possible time to track is at high noon, when the sun is at its highest and shadows are minimal with respect to visibility.

2.12.1 Basic Man-Tracking

The main point of this section is not to teach man-tracking, but rather introduce it. Man-tracking is a skill that takes many years to learn and do well, and one section could not possibly show you everything that you would need to accomplish the task. What we hope to accomplish in this section is how searches are more successful when tracking and man-tracking skills are used.

Step-by-step methodology - man-tracking takes slightly different forms depending upon the environment one is searching. The step-by-step system is employed quite rigidly in sparsely vegetated areas. Other techniques include the step-by-step system without as much emphasis on the use of the *tracking stick*.

The man-tracker uses the tracking stick to find every clue left on the ground by the subject's tracks. The man-tracker must take note of any flora that is disturbed. Also the changing seasons are more dramatic, and therefore require a more intimate knowledge of the flora in each season in order to find patterns of disturbance.

In using the tracking stick, the man-tracker needs to realize that you may not see a track for several feet. This may be the result of the type of terrain, or possibly weather conditions after the track was made. Using the stick in conjunction with common sense and observation allows the man-tracker to make an educated guess as to which direction the missing or lost person(s) went. Thus, the man-tracker is allowed to skip tracks and still follow the trail. Just because you don't see a track does not mean that the person did not step there. All it means is that the person did not leave any obvious clues.

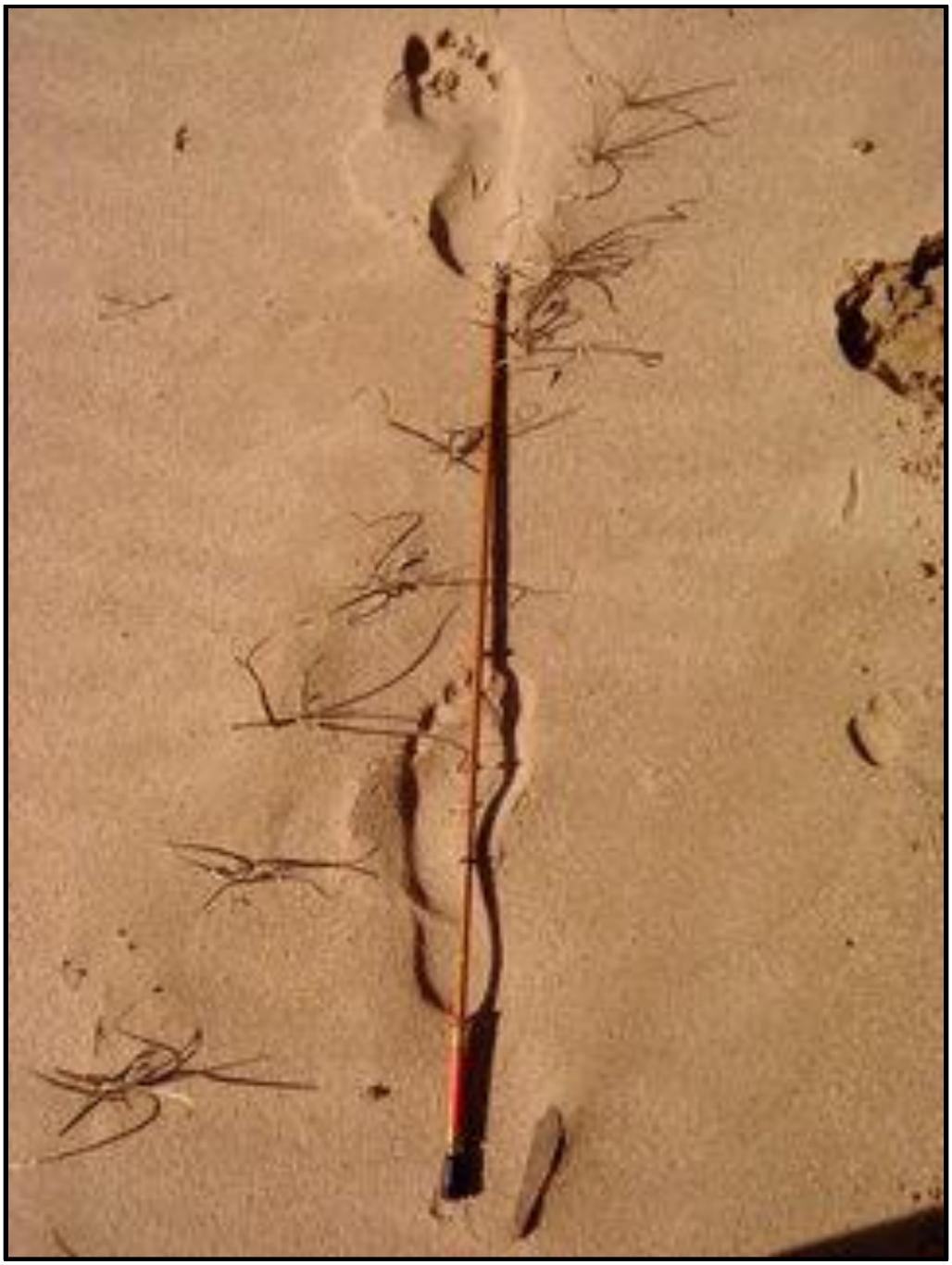

Figure 2-17 Tracking Stick

The tracking stick is usually a stick 4 to 6ft long which is used to approximate both the length of the subject's shoe or track and the subject's average stride. The stick allows the searcher to focus on the next most probable area to find the subject's next step, as depicted in ***Figure 2-18 Using a Tracking Stick*****.**

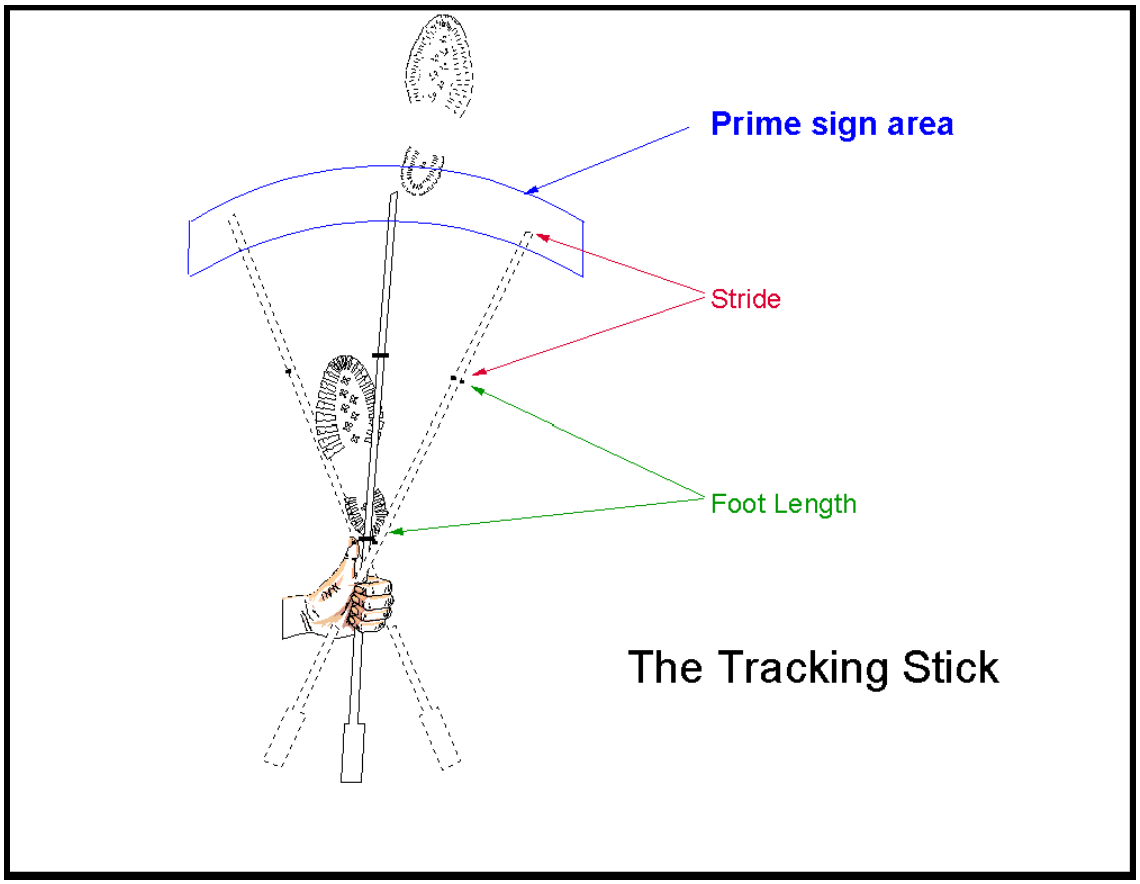

Figure 2-18 Using a Tracking Stick

Don't always look for footprints. Footprints may not be left on the terrain, but some definite marks probably were. Look to see if rocks, leaves or grass have been moved out of what appears to be normal. Look for broken branches or stripped leaves at normal hand height along the path; the person may have broken them off as they walked through. Consider the characteristics of the missing or lost person(s) that you are looking for.

Different personality types and objectives tend to make people do different things. Children see things differently than full-grown adults, and a path to them may appear to be a wall of bushes to adult searchers. Hunters and berry pickers often go off the beaten path to conquer their objective, but then can't get back. Being observant and having as much information on the missing or lost person(s) as possible allows you to plan accordingly.

2.12.2 Track Identification

Teams often come across tracks in the field, but because they have not been properly trained, the tracks go unnoticed, are damaged, or are reported poorly or incorrectly. When you find a track during a perimeter or hasty search, you should draw a detailed sketch. You may have to describe the track to the command post or to other teams. This may be done face to face, or even over the radio. If so, you should describe the track in such a way that anyone listening can draw the same sketch as you have drawn.

The following questions represent the current ideas about how a track can best be described over the radio. If you are able to answer these questions, you can probably accurately describe the pattern noticed to anyone.

- *Are the right and left prints mirror images?* In most cases the answer will be no, but this is not necessarily a problem. The differences between them may actually make it easier to distinguish this print from others in the area, and make it easier to find overall.
- What is the basic type?
- Is it a track of a flat shoe (no heel)?
- Does the person appear to be wearing footwear that has a distinct heel or toe?
- Does it appear that the person is barefoot?
- What is the shape of the track in terms of the toe, heel, and instep?
- Is the toe of the track pointed, rounded, box or square shaped?
- Is the leading edge of the heel straight or curved?
- Is the instep high or low?
- What are the overall dimensions of the track in terms of the following? (Refer to ***Figure 2-19 Track and Stride Measurements*** for a visual description).
    - Overall length
    - Sole width
    - Heel width
    - Heel length (if any)
    - Stride (heel to heel)

NOTE

When working with other teams, be sure to state whether stride is stated in terms of heel to heel (e), toe to toe (f + a), heel to toe (e + a), or toe to heel (f). It is recommended to use heel to heel since heel prints are usually easier to see than toe prints because of where a person's weight is focused on the foot.

- Is there a pattern shown on the track? The tracker should consider many things for this.
    - Are there any distinguishing marks on the borders of the track? Does it appear to have a sewn or stitched edge? Does the border appear to have divots along the edge possibly showing where nails are used to secure the sole of footwear to the shoe bottom?
    - Are there any distinguishable labels, trademarks, or numbers shown in the track?

- Does the track appear to show a pattern transferred from the person's shoes? Is it plain (no pattern), regular, irregular, or mixed? (See ***Figure 2-20 Examples of Shoe Sole Patterns***).
    - Regular markings are those that are generic symbols typically found in manufactured shoes.
    - Irregular markings are considered to be patterns such as diamonds, concentric circles, semicircles, arcs, bars, or stars. If the markings are irregular, note the location and direction on the track for each marking. Measure locations of these markings as accurately as possible so that they can be distinguished from similar varieties or styles at another location.
    - Mixed markings are exactly that, a mixture of markings. Multiple patterns of regular, irregular, or both types of markings could be found on the same track.

NOTE

A fine or worn pattern may appear to be plain if the ground surface is too coarse.

- Is there a distinct heel pattern, noting the outline, nail holes, and whether edges are slanted, rounded or straight?

NOTE

Nailed heels will generally have either 8 holes (having three across the leading edge) or 13 holes (having 4 across the leading edge).

- Does the track have any unique features that will make it different from others like it? Are there cuts, worn spots, or heel plates noted on the track?
- Does the person appear to have a pattern demonstrated in the track? Does the track show that the person toes in or out? Does the track indicate that person makes deep toe marks or heel marks? Does the person drag one or both feet in walking, noted by scuff marks? Does the person appear to be favoring one leg, possibly noting a limp or injury?

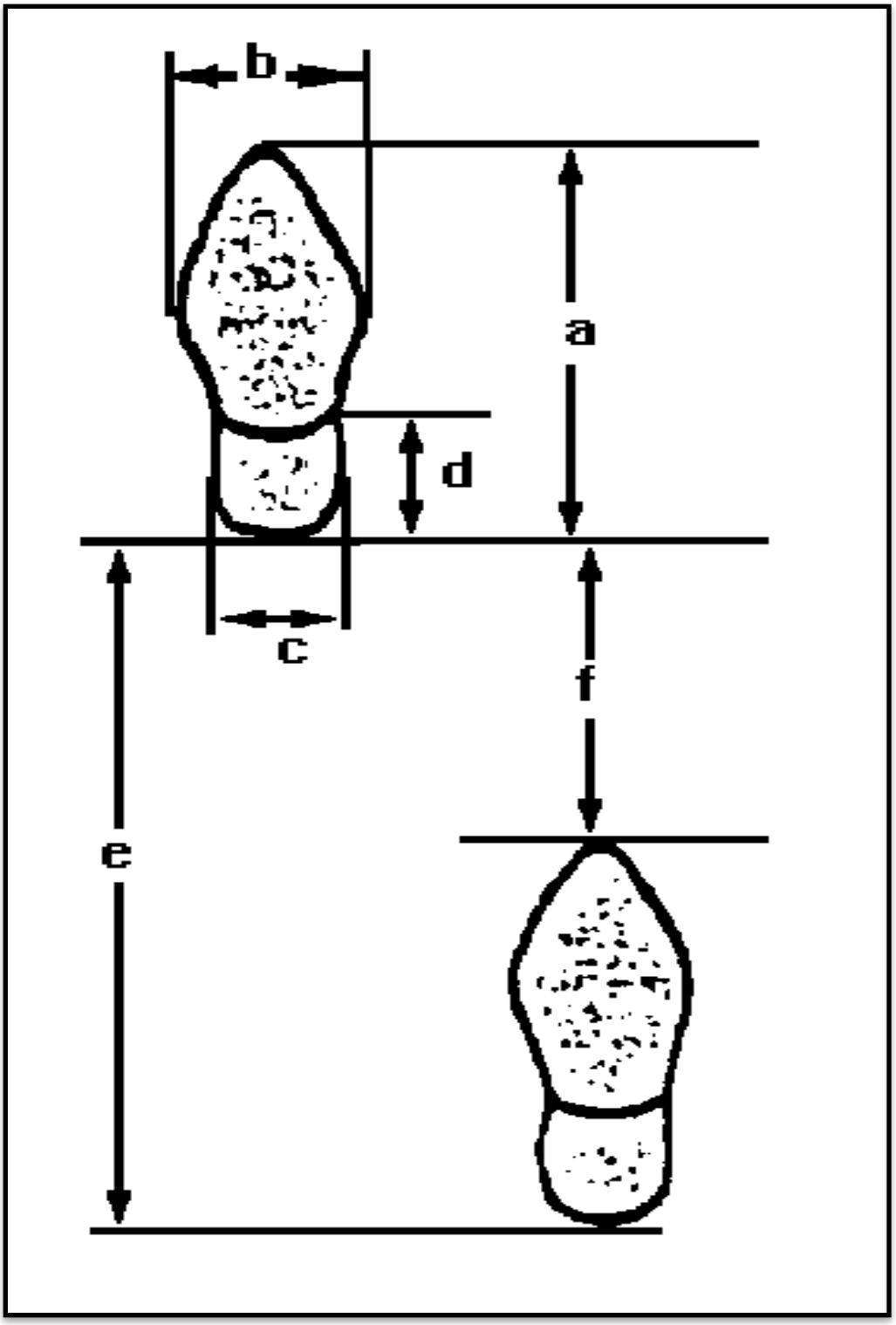

Figure 2-19 Track and Stride Measurements

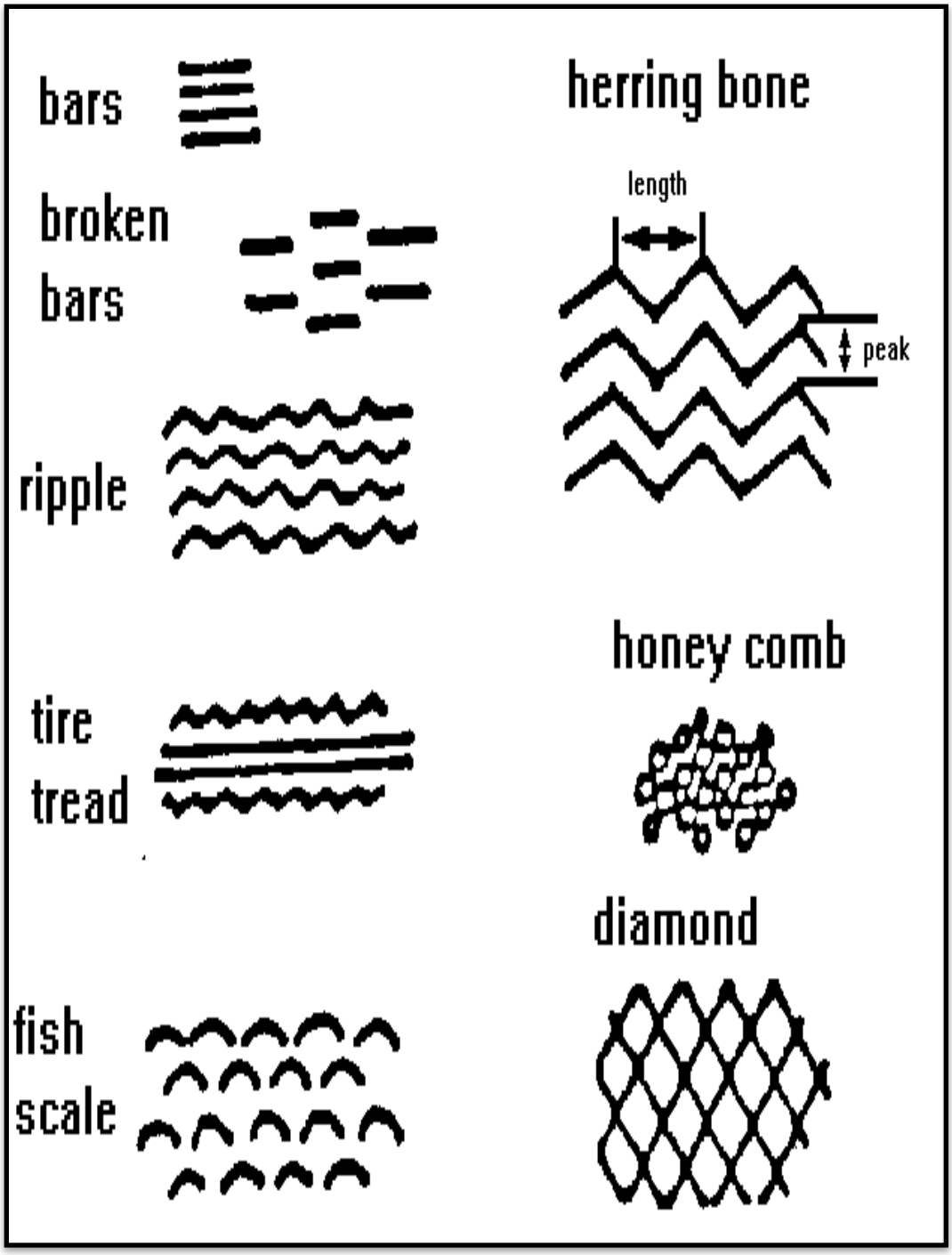

Figure 2-20 Examples of Shoe Sole Patterns

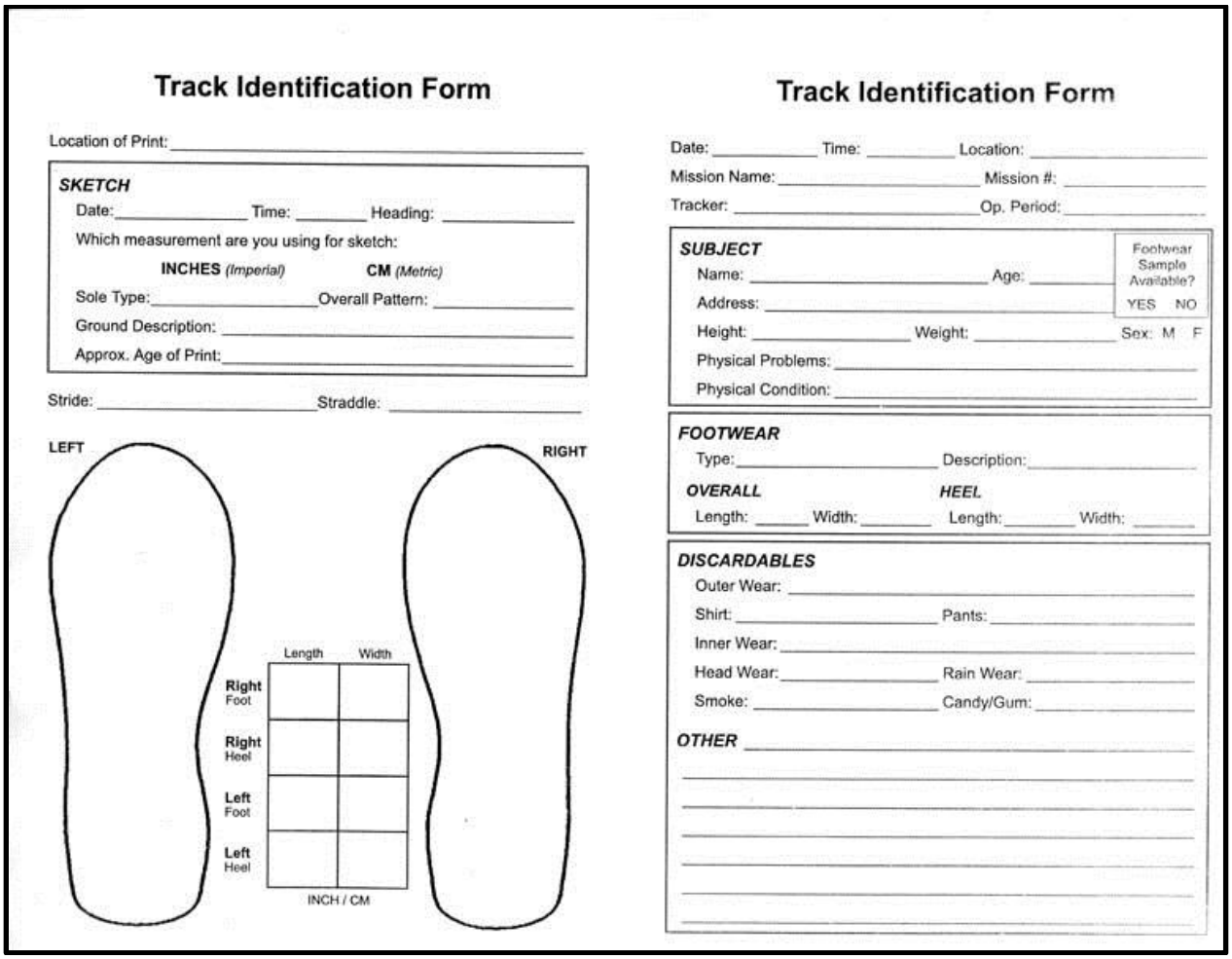

Figure 2-21 Sample Track Identification Form

The following types of tracks occur often enough that they have been named. As long as everyone uses these names to mean the same thing, much time can be saved in describing a track.

- *Sneaker* - molded heel and toe, usually plain (because fine patterns don't show), or else fine regular pattern without any border. Many times these are also referred to as deck shoes or tennis shoes.
- *Gym shoe* - flat (no heel); coarse pattern, usually irregular geometric shapes with a definite border.
- *Lug boot* - separate heel and toe; coarse lug and star pattern. Many times these are referred to as Montagna Vibram, Security Vibrams, or Klettershuhs. At the same time you should also try to learn how to recognize different types of military and/or hiking boots popular in your area; it could save you some time.

Practical Exercise

Basic tracking – start on a gravel path and continue to long grass and return to the path.

Dirt transfer - Start on terrain which will provide a good impression of the print, walk to an area that has a hard surface and track onto that surface to detect dirt transfer.

Tall grass exercise – walk through an area of tall grass in single file and examine from different angles to see how the light and angle at which the grass is leaning allows for detection.

Print recording - find a positive impression, record all the information of the print. What are the dimensions? What are the characteristics of the print? Is it new or old? What is the direction of travel? Can you find the other print?

Exercises can be done during the day or night. Special attention should be paid to the time of day (i.e. high noon). What difficulties does tracking bring during high noon?

For additional tracking exercises, see Section ***2.9 Clue Awareness***, Practical Exercise.

2.13 Team Procedure for Identifying Clues

OBJECTIVE: Provide guidance to searchers of the team protocol surrounding the discovery of a clue and the importance of preserving the scene.

During the course of a search, members will come across items found which may or may not be considered clues. The following are recommended steps which a searcher should take in the event of finding a clue:

- Upon discovery of clue the search line is to stop and remain in position.
- The team leader will be required to verify the authenticity of the item(s) found; approach and exit on the same path and record all details in his/her notes.
- The team leader is to ensure command post has been notified; this is to include description of clue, location to be provided by GPS and time of day.
- If the clue is relevant as determined by command post, members will then secure the scene to prevent contamination of area.
- Searchers should maintain their positions and not approach the clue, as this can potentially contaminate the scene.
- Notes to be taken by all members as to current position and tasking (see Section ***2.15 Note Taking***) – attention to accuracy and detail is vital.
- Team members are to standby for further instructions.

It should be noted that it is not the responsibility of the member to conduct an investigation or collect evidence on behalf of the police. Their duty is to search and notify once an item has been found.

NOTE

This is only a guide as to the preservation of clues found. Follow your team's procedure.

Practical Exercise
Have team members discover clues and take the steps as noted above. Introduce a variable to compromise the integrity of the clue to force the team to take the steps necessary to preserve the clue in its current state. This will show resourcefulness in a time of urgency, and will reinforce the importance of maintaining the continuity of evidence. Change this up by conducting this exercise during the day or night. This can be combined with practical exercises in Section ***2.15 Note Taking***.

2.14 Team Roles

OBJECTIVE: Provide awareness of search team roles.

2.14.1 Team Leader

The following depicts roles and responsibilities of a team leader:

- Ensure each member is equipped with the required gear to perform assigned task.
- Ensure each member is capable, both mentally & physically, to perform assigned tasks.
- Ensure each member possesses required skills and knowledge to perform assigned tasks.
- Conduct team briefing/de-briefing.
- Assign roles to team members.
- Control the search line or search pattern utilized and make changes as required.
- Control communication with command post and other units.
- Scribe/record as required.
- Investigate any clues found.
- Oversee the safety of team members.
- Establish the POD of the area in collaboration with team members.
- Monitor searchers (fatigue, hydration and condition).
- Establish critical spacing/distance.
- Responsible to command post – receiving and reporting instructions/tasking's.
- Sign out equipment as required.
- Sign equipment back in as required.
- Be able to direct and redirect searchers.

2.14.2 Team Member

Team member's roles and responsibilities may include numerous types of positions on a search line and can include the following:

- Communication person.
- Flagging person.
- Navigator.
- First Responder/First Aider.
- Searcher.

2.14.2.1 Communication Person

As the team communication person, responsibilities may include:

- Maintain communication with command post and team leader/members.
- Conduct search function.
- Take notes.
- Prior to departure to assigned location, ensure radios are operative.
- Perform radio check with command post.
- Carry spare batteries.
- Perform basic radio troubleshooting.

2.14.2.2 Flagging Person (hip chain if required)

As the team flagging person, responsibilities may include:

- Flag boundaries (include any identification note as per team protocols).
- Conduct search functions.
- Take notes.
- Removing flagging tape when required.
- Keep adequate supply of flagging material.

2.14.2.3 Navigator

As the team navigator, responsibilities may include:

- Use compass, map and GPS to ensure team stays on assigned course.
- Know where the team is within their segment (use of tally system).
- Mark location of clues on the GPS when required/directed.
- Maintain a working map (if no GPS).
- Conduct search functions.
- Take notes.

2.14.2.4 First Responder / First Aider

As the team first responder/first aider, responsibilities may include:

- Carry team medical supplies.
- Administer first aid as required.
- Provide on-going patient care.
- Communicate with emergency services personnel(patient condition).
- Conduct search functions.
- Take notes.

2.14.2.5 Searcher

As a searcher, responsibilities may include:

- Conduct search functions.
- Take notes.
- Assist others as required.

NOTE
Responsibilities may be assigned to others on the team, for example, anyone of the members may be assigned to maintain a tally count. All team members will receive their assignments from the team leader.

For further information and details on team roles and responsibilities, see Section ***7.16 Team Roles and Responsibilities***.

2.15 Note Taking

OBJECTIVE: Discussing the importance of note taking during a search. Providing a guide as to how notes should be written, including incident number, time, date, location, team leader and members of the team.

Note Taking - the relevant information, the chronological order in which information has been entered; what notes should be taken before the search, during the search and after the search.

Notes should be neatly written. They should be written in such a manner as they can be easily referenced. Notes made should be entered shortly after the event has taken place as to not be clouded by time.

Most notes are written in a notepad. They are easy to pack, not bulky, and convenient to use. Notepads are available with standard lined paper, or all-weather grade paper, also known as an outdoor notepad. Either way, carrying a notepad with you during a search is an important tool to have. Carry more than one writing instrument with you, in the event that your pen or pencil fails.

When beginning the first entry, notes should be written in 4 parts:

- Date - THURSDAY, OCTOBER 18, 20__. You may want to include a task number and arrival time just under the date - THURSDAY, OCTOBER 18, 20__, and arrival 0900 (Task # 20__ – 001).
- Location, weather conditions and personnel involved.
- Briefing Notes - record relevant facts from the briefing (information about who or what your team is looking for). Record as much information as possible as you may have to refer to it once you're out in the field.

- Search Notes – any relevant information taken while in the field.
- De-Briefing Notes – following search operations, record any relevant information given during team de-briefing.

NOTE

Remember - your team may want you to adhere to certain protocols regarding notes, this is just an example:

THURSDAY, OCTOBER, 18, 20__
Task # 20__-001
Search time 0900 hrs
GRAVENHURST, ON
+15C, Overcast
Team Alpha
Team Leader - J. Sterling

The purpose of the briefing is to provide enough information for the search team to do their job. Record this information. You may very well have to rely on this information during the search.

During the search your team leader most likely will be taking notes upon discovery of a clue or piece of evidence. Should you be assigned this duty of note taker, it is vital that you accurately record the time, location, MGRS (grid reference), description of item found. Should you meet a person, hiker, camper or possible witness, it is a good idea to discretely record their information as they are interviewed. Remember, you are a searcher, not a police officer; the note taking and the questions may offend and upset some people.
The role of the searcher is to search for their subject or clue, navigate using GPS, map and compass, count tallies, or whatever their duty is on the line. Note taking is a skill that should be learned by everyone involved with SAR, from incident commander to ground searcher.

Practical Exercise
In class training session – provide a mock search board, include the task number, date, and provide a brief of the search. After about 30 minutes, have members read back what was provided in the brief, ask questions that will force the members to refer to their notes.

During a search exercise, have one member record information relating to clues and/or evidence found during the task, ensure detailed records are kept. Upon returning to command post, when consulting with search manager, have member report findings using their notes.

2.16 Safety

OBJECTIVE: The SAR environment is inherently a dangerous place to operate. SAR personnel are exposed to a whole range of hazards and a high potential of injury. It is the responsibility of all SAR personnel to mitigate these hazards as much as possible. Team leaders must have an open dialog with their members about safety and must not ignore safety concerns.

2.16.1 Individual Responsibility

Every member of a SAR team has a responsibility for the health and safety of the group.

- Volunteers must take reasonable care to protect their safety and the safety of others who may be affected by their acts or omissions. If it looks unsafe, or *feels* unsafe, *DON'T DO IT!* Communicate it up, down and across the chain of command.
- Participate in training and orientation activities required to safely undertake assigned roles and responsibilities.
- Provide records of completed training and certification to a team leader that is taken with other agencies, such as first aid.
- Follow safe work practices and procedures when training, exercising and responding.
- Use all safety materials, equipment, devices and clothing issued.
- Advise team leader if member believes that their assigned activities cannot be performed safely. You have the right to refuse unsafe work.
- Immediately report all incidents of unsafe situations, hazards, accidents and injury to a team leader.
- Don't engage in any improper activity or horseplay that could create a hazardous situation
- Ensure member's ability to work is not impaired by alcohol, drugs or other influences.

2.16.2 Team Responsibility

The team leader and the SAR Organization have added responsibilities:

- Take all reasonable and practical steps to ensure the safety of team members.
- Develop and implement safe work practices and ensure all members attend required safety training courses.
- Assign members to activities that are consistent with their knowledge, skills and ability.
- Remove any member from activities if there are concerns as to the member's ability to safely perform their duties.
- Ensure appropriate emergency medical response services are provided or available to members.
- Ensure hazards are identified and proper steps are taken to control the risks.
- Report and investigate incidents and near misses (including those that had the potential to cause serious injury) and accidents.
- Ensure regular inspection of the worksite and correction of unsafe conditions (this might include building and vehicles if owned by the team).

- Instruct and coach members to follow safe work procedures.
- Ensure only authorized and trained members operate equipment.
- Ensure necessary personal protective equipment (PPE) is provided to members and that PPE is used, inspected and maintained properly.
- Ensure the safe handling, storage and disposal of hazardous materials.
- Ensure contaminated equipment is adequately decontaminated or disposed of correctly.
- Promote a culture of safety and member care awareness.
- Cooperate with other agencies and first responder groups in dealing with safety and member care issues.

2.16.3 Volunteers and the Labour Laws

Volunteers are not covered by the Employment Standards Act, 2000.
Under the Workplace Safety & Insurance Act, 1997, some volunteers are covered in certain situations. In Ontario, the law deems a volunteer to be an employee in specific circumstances.

An emergency volunteer is an employee when an authority who summons them to assist in controlling or extinguishing a fire shall be deemed to be the person's employer. (1997 c.16, Sched. A, s. 71 (1))

In a search and rescue operation, the Crown shall be deemed to be the employer of a person who assists in a search and rescue operation at the request of and under the direction of a member of the Ontario Provincial Police. (1997, c. 16, Sched. A, s. 71 (2))

In a declaration of emergency, the Crown shall be deemed to be the employer of a person who assists in connection with an emergency declared by the Lieutenant Governor in Council or the Premier under section 7.0.1 of the Emergency Management and Civil Protection Act. 2006, c. 13, s. 4 (2).
In a declaration of emergency the municipality shall be deemed to be the employer of a person who assists in connection with an emergency declared by the head of the municipal council to exist. (1997, c. 16, Sched. A, s. 71 (4)) (2006, c. 13, s. 4 (3))

Under the Occupational Health and Safety Act, a worker is defined in part as being "person who performs work or supplies services for monetary compensation". Although this definition does not include volunteers, employers still have some responsibility for the health and safety of people visiting or helping out in their workplaces.

2.16.4 Injuries on Search

If a searcher is injured while operational or during training, immediately stop and render first aid to your level of training. Contact command post and inform the chain of command. Assess the situation and decide if the patient can be moved or if first aid must be continued in place until EMS has arrived. Depending on the situation, terrain and weather the patient may need to be transported out to a trail or road. Once the emergency has been dealt with there will be documentation that will need to be completed.

- Complete a report on the first aid that was rendered.
- Description of the accident and any equipment involved in the accident.
- Time and place of the accident.
- Name and address of patient.
- Name(s) and address(s) of witness(s).
- Name and address of attending physician or surgeon.

Keep all reports and records on file for at least one year or, longer if necessary to ensure that the two most recent reports or records are kept.

2.16.5 WSIB Procedures

An Employer's Report of Injury/Disease Form 7 needs to be completed and sent on to the WSIB within three calendar days, each time that a work-related injury or disease causes a worker to:

- Obtain health care (*health care* includes services provided at a hospital or health care facility and by health care practitioners, that is, doctors, registered nurses, chiropractors, physiotherapists or dentists).
- Be absent from regular work, require modified duties at less than regular pay.
- Require modified duties at regular pay for more than 7 calendar days from the date of the accident.
- Earn less than regular pay at regular work (Form 7, Reference Guide for Employers, WSIB).

If an accident results in a fatality, state this clearly on the form. Answer all questions fully. If you do not have all the required information, send in what you have, making a note that you will provide the missing information as soon as possible. If you doubt the employee's version of the accident or injury, or if any circumstances justify an investigation, state this in the appropriate space in the form. Attach a letter asking for an investigation, and give your reasons for the request.

While the Workplace Safety and Insurance Act deal largely with compensating workers who suffer work-related injuries or illnesses, the purpose of the Occupational Health and Safety Act is to prevent workplace injuries and illnesses. This Act and the Industrial Establishments Regulations have requirements for reporting and/or recording workplace accidents that result in (OHSA s.51 and s.52):

- Fatalities and critical injuries.
- Occupational illnesses.
- Disabling injuries.

Critical injury would involve the following (O. Reg. 834 Critical Injury defined):

- Places life in jeopardy.
- Produces unconsciousness.
- Involves the fracture of a leg or arm (but not a finger or toe).
- Involves the amputation of a leg, arm, hand or foot (but not a finger or toe).
- Consists of burns to a major portion of the body.
- Causes the loss of sight in an eye.
- Results in a substantial loss of blood.

If the employer is advised that a worker has an occupational illness or has filed a claim with the WSIB, the employer must give written notice within four days to the following (OHSA s.52(2)):

- Ministry of Labour Director.
- Health and safety committee or representative.
- Trade union, if any.

The notice must contain all the information specified in Content and Format of Reports.

NOTE

There is no time limit for an employee to file an occupational disease claim with the WSIB.

Disabling injury is an injury that disables a worker from doing his or her usual work. In the case of a disabling injury, where no other person is killed or critically injured as a result of the incident, give written notice, within four days, to the following (OHSA s.52(1)):

- Health and safety committee or representative.
- Trade union, if any.

2.16.6 Safety Program

Every SAR organization should have a safety program in place. This program should be modeled on programs that have been successful in other industries to reduce or mitigate the hazards that present themselves. The safety program should include the following elements:

- Procedures, policy and record keeping.
- Inspection and hazard assessment.
- Training.
- Equipment.
- Forum for discussion of safety.

2.16.6.1 Written Procedures, Policy and Record Keeping

Every safety program at its core needs to have written documentation which provide details on how safety will be incorporated into the work that volunteers are doing, will be reviewed on a regular basis and what to do in an emergency or accident situation. Other written elements that are typical of a safety program include:

- General Standard Operating Procedures (SOP's) for SAR operations. This document will detail how the team will conduct searches and who and what each member will be responsible for doing.
- Safe work procedures can be incorporated into the SOP's or can be broken down into specific areas or equipment, but needs to provide guidance on how to carry out work. Some specific safe work procedures could include:
    - Procedures for the initiation and maintaining control of traffic.
    - Procedures for use of all specialized rescue equipment immediately available and in use by the organization.
    - Personal Protective Equipment (PPE) use and maintenance.
    - Vehicle safety and inspection.
    - First aid practices and procedures. How will first aid be documented and the records kept.
    - Heat and cold stress.
    - Storage of dangerous materials such as fuel, batteries etc.
    - Injury and violence prevention.
- Emergency planning needs to include not only a response plan but a communication plan and hazard controls.
- A schedule for inspections and detailed list of what to inspect and how to audit the inspection forms.
- A training plan for the integration of new members and the retraining of long standing members. Training also needs to include what records are to be created and how they will be maintained.
- How is health and safety to be administered? Who is responsible for what? How will it be documented and what is the mechanism for assessing and enforcing compliance with safety laws and regulations?

Having a written safety plan is one element of demonstrating due diligence when it comes to the safety of the team and members. These policies and procedures need to be approved at the highest levels of the organization to ensure that the commitment is made from top to bottom. As a matter of legal requirement a copy of the latest version of the document should be signed, dated and kept on file. The policy should be posted or distributed to all members. Within the policies there should be a mechanism for periodical review and update.

2.16.6.2 Inspection and Hazard Assessment

Inspections and assessments of hazards will serve to identify and correct unsafe conditions before an accident occurs. The Ontario Health and Safety Acts lays out requirements for workplaces. As many SAR groups do not own a workplace but operate out of other locations much of these regulations do not apply. That said, most SAR

groups do own equipment and this should be inspected regularly and formal records kept of these inspections.

The process of inspection needs to be documented and include process to follow up on deficiencies. If the equipment is specialized then what qualifications does the *inspector* require?

2.16.6.3 Training / Education and Certification

Training is a crucial component of the safety program. It ensures that a common standard exists in the SAR team and builds confidence in the team that everyone has been trained to the same level.

The first step in the training system should be an orientation for new members, which clearly lays out what can and cannot be done by new members and what level of training is needed and when this training is given. Orientations are a good place to present team SOP's and other written policies to the new members.

Training should take place when a member is also given a new task and records kept of each of these training workshops. Much of the language regarding health and safety requires that a person be competent.

NOTE

Ontario OHA 1990 definition of *competent person* means a person who,
(a) is qualified because of knowledge, training and experience to organize the work and its performance,
(b) is familiar with this Act and the regulations that apply to the work, and
(c) has knowledge of any potential or actual danger to health or safety in the workplace

Specific training that may need to take place depending on the nature of the SAR environment includes:

- *Personal Protective Equipment* - Workers who wear protective clothing or use personal protective equipment or devices. Instruction and training in the care and use of the clothing, equipment, or device. Construction Regulation section 21 (3)
- *Vehicle Licenses* - Worker who operates a vehicle at a project. Competence to operate the vehicle. Construction Regulation section 96 (1)
- *Fall Protection* - Workers who use a fall protection system. Training in its use *and* adequate oral and written instructions (written records). Construction Regulation section 26.2 (1).
  No worker in Ontario is allowed to climb a ladder or work on a platform that is higher than 10 feet off the ground without having fall protection in place. Fall protection includes the proper CSA approved equipment, training and having an extraction plan if a fall should occur.
- *Confined Spaces* - Firefighter or gas technician who performs emergency work in a confined space. Training to work safely in confined spaces. Construction Regulation section 221.3 (2) (b).

A confined space means a fully or partially enclosed space that is not designed nor constructed for continuous human occupancy in which atmospheric hazards may occur because of its construction, location or contents, or because of work that is done in it. Examples of potential confined spaces include:

- Tanks, drums.
- Tank cars, holds.
- Manholes, sewers, shafts.
- Silos, bins, hoppers.
- Tunnels, culverts.
- Vaults, lockers.
- Cellars, pits.
- Vats, tanks, vessels, tubs.
- Ditches, wells, walls, pits.
- Pipelines, ducts.

- *Water* - Drowning protection. Workers (at least two) who shall be available to perform rescue operations, if a worker may drown. Training to perform rescue operations. Construction Regulation section 27 (2) (a).
- *First Aid* - At least one worker for work crew of five or less. *Emergency First Aid* training program. First Aid Reg. 1101 sections 8 (2), 9 (2), and 10 (2).
- *Helicopter* - Ground personnel including a signaler for a helicopter being used to hoist materials. Competent worker. Construction Regulation section 167 (3).
- *Traffic Control* - Traffic control worker who directs vehicular traffic. Competent worker *and* adequate oral and written instruction to direct vehicular traffic, including a description of the signals that are used, in a language the worker understands. Construction Regulation section 69 (4).
- *Underground* - Tunnels, shafts, caissons, and cofferdams. Workers (at least four) who are readily available to perform rescues of underground workers. Training (30 days before tunneling begins) to perform rescues of underground workers. Construction Regulation sections 265 (1) and 265 (5)

2.16.7 Forum for Discussion of Safety

When an accident, injury, near miss or unsafe condition is reported, it must trigger action. The safety program should lay out who to report to. Which incidents are investigated, when and by whom? Also it should state what kinds of records are made, how long they will be kept and what sort of follow up is required or expected.

As part of the ongoing commitment to safety, a committee drawn from various levels and jobs should be meeting regularly to analyze and identify trends. They should look at:

- Where most of the accidents are happening?
- What injuries and illnesses are most common?
- What processes, equipment, tools or materials are involved?

This committee should be keeping informed as to changes in regulations, new equipment and practices. The committee should seek to improve health and safety in

the organization. The committee should put forward measures that can be documented and assessments done of what recommendations have improved the safety record. Rather than just looking at accidents, the committee should also address prevention of accidents.

2.17 Missing or Lost Person(s) Found Procedure

OBJECTIVE: To inform searchers of proper procedures when the missing or lost person(s) has been found.

If a team member believes they have found the missing or lost person(s), the searcher directs the team leader to *hold the line*. Team leader communicates at all times with and follows directions from command post.

Documentation must be done by all team members and should include:

- Date/time of day/weather.
- Team name and task assigned.
- What the team member saw (clothing, visible clues).
- What each team member did.

The area is then checked for safety and/or hazardous conditions prior to proceeding to the missing or lost person(s). The team leader advances to the area to determine the condition of the person. Using a calm voice, the team leader reassures the person by letting them know who they are and that they are there to help.
The team leader then informs the command post of the condition (responsive, unresponsive/alive and well/critically injured, etc.) of the missing or lost person(s).

If missing or lost person(s) is r*esponsive and mobile:*

- Determine if first aid is needed.
- Determine if missing or lost person(s) can walk, talk, and is aware of who and where he/she is.
- If requested, small amounts of liquid or food can be given; the searcher must inquire about any food allergies at this time.
- Determine mode of transportation out of area
- Team leader communicates at all times with and follows directions from command post.

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If missing or lost person(s) is i*njured:*

- Team leader or most experienced medical person determines severity of injury(s).
- Start and continue to apply first aid.
- Determine mode of transportation, can he/she walk, does he/she need to be carried using stretcher or use an ATV or snowmobile. Is a helicopter required?
- Team Leader communicates at all times with and follows directions from command post.

If subject(s) is *non-responsive, or believed to be deceased (a decision determined by medical authority only):*

- Team leader communicates at all times and follows direction from command post by using a secure radio channel and using a coded message, (code black or Vital Signs Absent (VSA)). Get approval to proceed or wait for police of jurisdiction.
- If proceeding, the team leader or most experienced medical person goes to the victim.
- The searcher/medic going in to victim flags his/her footsteps in and out, careful not to disturb any evidence.
- Team leader assigns area to be secured for no trespassing.

NOTE

Searchers should be aware of special codes established by their individual teams.

3 Equipment

OBJECTIVE: To focus on what ground searchers will require in the way of individual equipment, including the 24 hour pack, 72 hour pack and what clothing should be worn by search members while on training and/or search operations.

We will examine what personal equipment is required and what will constitute a 24 hour/72 hour pack that a searcher will carry while deployed. In some cases the searcher will not call upon the contents of his/her pack, but should there be a need to do so, everything that a searcher will require, will be there. Items contained inside the pack can range from matches to dry clothing, to food. This pack should always be ready to go, regardless of the weather conditions and time of year.

3.1 Individual Equipment

Looking at what individual equipment the searcher should carry with him/her depends on what their team is able to provide. Most teams will be able to provide the basics in the way of some equipment. Items such as radio, GPS, compass, high visibility vests can be provided. However, should the member require more equipment, then that would be their responsibility. Some teams will have suggestions as to the type and brands of equipment to purchase, this is just a guide:

- Team uniform.
- Appropriate clothing and footwear.
- High visibility clothing – (surveyor's vests are great as they have many pockets and are oversized to be worn over a jacket).
- Walking stick.
- Personal radio (make sure that it is licensed to operate on the same frequencies as your team).
- GPS – best to have a unit that is similar to your teams.
- Gators – helps to protect and keep lower legs dry.
- Snowshoes.
- Cross country skis.
- Helmet – rock climbing helmets are good as they have a strap to prevent them from falling off and can be fitted with a face shield if need be.
- Safety glasses.
- Sunglasses.

- Handheld flashlight.
- Proper well fitted backpack.
- Hydration pack.
- Gloves.
- Zip ties.
- Rope or cord – 15m.
- Hand warmers.

While not all of the items listed are commonly carried during a search, if you are in a location where the possibility of staying overnight is a regular event, then the previously listed items should be something that the searcher would be taking with them along with their 72 hour pack, while on task.

3.1.1 24 Hour / 72 Hour Packs

24 hour pack - A searcher should *be* self-sufficient for at least 24 hours in the event that they are required to spend the night during the search. Remember that if you have to be transported to your staging area or from your staging area to your start point, bring your pack. Do not deploy without your equipment/pack. The weather may move in and force you to wait it out, better to do this having equipment with you.
Some recommended items that the 24 hour pack should contain are as follows:

- Water – at least 1 liter.
- Food – energy bar/chocolate bar.
- Waterproof matches & fire starter.
- Emergency candle.
- Knife – solid blade, locking type blade or multi-tool.
- Flashlight and/or head lamp.
- Spare batteries (radio, GPS, flashlight (spare bulbs) etc.).
- Rope (approx. 15m).
- Toilet paper, hand sanitizer.
- Map and compass (mirror can be used as a signaling device).
- Pen and/or pencil and paper (notepad)
- Pot/cup – to hold and boil water.
- Whistle (pea-less type preferred).
- Personal first aid kit.
- Dry socks and shirt (quick dry – packaged in a zip-lock bag to remain dry).
- Zip-lock and garbage bags – varying sizes (could be used to protect clues/evidence).
- Disinfectant tablets (water purification).
- Tarp/poncho.
- Folding saw.
- (2) 12 hour glow sticks.
- Emergency blanket.
- Sunscreen and bug repellent.
- Plus any additional item required.

72 hour pack - Some recommended items for a 72 hour pack should include:

- All the contents from the 24 hour pack.
- Extra food.
- Sleeping bag – preferable a compact bag to save space.
- Stove and fuel.
- Water filter.
- Toiletries – soap, tooth paste, tooth brush, comb, wash cloth, towel.
- Extra clothing.
- Tent.
- Tarp – large enough for the base of the tent

Your team may require you to carry additional equipment. The equipment that you carry in your pack should be adjusted for the seasons. You might want to keep spare batteries for your equipment closer to your body than in your pack. The type of dry socks that are in your pack may have to be thermal socks instead of lightweight hiking socks normally used in the summer months. Bug Repellent will not likely be used during the colder seasons. Things like sunscreen may be used in all seasons, providing protection from above in the summer and from the reflection from the snow in the winter.

3.1.2 Clothing

Searchers will respond to calls in all weather and seasons, in the wind and rain, sleet and snow; it is ideal to stay warm and dry, or in some cases, cool and dry.

The age old adage *cotton kills* holds true as cotton retains moisture and steals body heat. It is best to wear something that *breathes*, something that allows moisture to evaporate from the body quickly while being able to retain heat.

For years, before *dry wicking* types of clothing, wool and down were widely used (and are still used today). Nowadays, we have fabrics such as fleece and micro-fleece, polypropylene, micro-fiber, extra shell material such as Gore-Tex. There are also soft shell exterior layers.

By wearing multiple layers (layered system), this will allow the wearer to *fine-tune* what they are wearing and to regulate their body's temperature. It is far easier to remove several layers and be comfortable instead of one heavy layer. During the cooler months (fall, winter and early spring), a searcher should be wearing:

- A polypropylene base layer (the first layer against the skin).
- Followed by lightweight layer (something that is not cotton, to allow moisture to escape).
- Then a fleece or micro-fleece layer.
- And finally a shell outer layer – either soft-shell or hard-shell (jacket and pants).

Protective clothing is needed for work at or below 4°C. Clothing should be selected to suit the temperature, weather conditions (e.g., wind speed, rain), the level and duration

of activity, and job design. These factors are important to consider so that you can regulate the amount of heat and perspiration you generate while operational. If the exertion pace is too fast or if the type and amount of clothing are not properly selected, excessive sweating may occur. The clothing next to body will become wet and the insulation value of the clothing will decrease dramatically. This increases the risk for cold injuries.

Clothing should be worn in multiple layers which provide better protection than a single thick garment. The air between layers of clothing provides better insulation than the clothing itself. Having several layers also gives you the option to open or remove a layer before you get too warm and start sweating or to add a layer when you take a break. It also allows you to accommodate changing temperatures and weather conditions. Successive outer layers should be larger than the inner layer; otherwise the outermost layer will compress the inner layers and will decrease the insulation properties of the clothing.

The inner layer should provide insulation and be able to *wick* moisture away from the skin to help keep it dry. Thermal underwear made from polyesters or polypropylene is suitable for this purpose. *Fishnet* underwear made from polypropylene wicks perspiration away from the skin and is significantly thicker than regular underwear. It also keeps the second layer away from the skin. The open mesh pattern enables the moisture to evaporate and be captured on the next layer away from the skin. The second layer covers the *holes* in the fishnet underwear which contributes to the insulation properties of the clothing.

The additional layers of clothing should provide adequate insulation for the weather conditions under which the work is being done. They should also be easy to open or remove before you get too warm to prevent excessive sweating during strenuous activity. Outer jackets should have the means for closing off and opening the waist, neck and wrists to help control how much heat is retained or given off. Some jackets have netted pockets and vents around the trunk and under the arm pits (with zippers or Velcro fasteners) for added ventilation possibilities.

For tasks conducted in wet conditions, the outer layer of clothing should be waterproof. If the area cannot be shielded against wind, an easily removable windbreak garment should be used. Under extremely cold conditions, heated protective clothing should be made available if it cannot be done on a warmer day.

You might want to carry separate rain gear, think about how breathable it is. Either you’re wet from the rain, or wet from sweat because your rain jacket doesn’t breathe; something to think about.

NOTE

Keep your rain gear near the top of your pack (easier to find in a time of need).

Gloves and hats offer warmth in the colder months and protection from the sun and shrubs in the summer. The best hats are something with a brim to keep the sun out of one's eyes and a toque in the winter to keep the heat from escaping and warming ears. Your team may have a policy in place regulating what slogans are permitted on any clothing. Check with your team before wearing such clothing on a search.

Almost 50% of body heat is lost through the head. Wool knit cap or a liner under a hard hat can reduce excessive heat loss.

Clothing should be kept clean since dirt fills air cells in fibres of clothing and destroys its insulating ability.

Clothing must be dry. Moisture should be kept off clothes by removing snow prior to entering heated shelters. While the searcher is resting in a heated area, perspiration should be allowed to escape by opening the neck, waist, sleeves and ankle fasteners or by removing outerwear. If the rest area is warm enough it is preferable to take off the outer layer(s) so that the perspiration can evaporate from the clothing.

If fine manual dexterity is not required, gloves should be used below 4°C for light work and below -7°C for moderate. For jobs below -17°C, mittens should be used.

Cotton is not recommended. It tends to get damp or wet quickly, and loses its insulating properties. Wool and synthetic fibres, on the other hand, do retain heat when wet.

3.1.2.1 Footwear

Felt-lined, rubber bottomed, leather-topped boots with removable felt insoles are best suited for heavy work in cold since leather is porous, allowing the boots to *breathe* and let perspiration evaporate. Leather boots can be *waterproofed* with some products that do not block the pores in the leather. However, if task involves standing in water or slush (fire fighting, farming), the waterproof boots must be worn. While these protect the feet from getting wet from cold water in the search area, they also prevent the perspiration to escape. The insulating materials and socks will become wet more quickly than when wearing leather boots and increase the risk for frostbite.

Foot comfort and safety - has some general information how to select footwear. (Also, when trying on boots before purchase, wear the same type of sock that you would wear in the field to ensure a proper fit.) Keep in mind that you will be wearing these boots for a very long time, so comfort is extremely important. Put them on in the store, walk around – once you bring them home, don't keep them in the box, put them on again and break them in. The only other thing that is worse than cold wet feet, are blisters caused by poor fitting boots. Research footwear before buying, learn about the foot and how one takes a step, this information may come in useful when selecting that particular boot.

Maintain the water repellence of the boots. Keep them clean; remove any mud or dirt from them once you've finished your search. Keep the boots dry. Take the insoles out,

loosen the laces, allow to the boot to dry naturally. Remember, boots are a piece of equipment that if taken care of, they will take care of you.

Socks - you may prefer to wear one pair of thick, bulky socks or two pairs - one inner sock of silk, nylon, or thin wool and a slightly larger, thick outer sock. Liner socks made from polypropylene will help keep feet dry and warmer by wicking sweat away from the skin. However, as the outer sock becomes damper its insulation properties decrease. If conditions permit, have extra socks available so you can dry your feet and change socks during the day. If two pairs of socks are worn, the outer sock should be a larger size so that the inner sock is not compressed.

Always wear the right thickness of socks for your boots. If they are too thick, the boots will be *tight* and the socks will lose much of their insulating properties when they are compressed inside the boot. The foot would also be *squeezed* which would slow the blood flow to the feet and increase the risk for cold injuries. If the socks are too thin, the boots will fit loosely and may lead to blisters.

3.1.2.2 Face and Eye Protection

In extremely cold conditions, where face protection is used, eye protection must be separated from the nose and mouth to prevent exhaled moisture from fogging and frosting eye shields or glasses. Select protective eye wear that is appropriate for the task you are doing and for protection against ultraviolet light from the sun, glare from the snow, blowing snow/ice crystals and high winds at cold temperatures.

Practical Exercise

In class have members arrive with their 24 hour packs. Have them go through their equipment to become familiar with the items that they have and learn how to use the equipment. Talk about the use of the items. Have members use some items in their pack. Disassemble flashlights, radios and GPS and change batteries, refold emergency blankets, or ensure that the toilet paper is stored in a zip-lock bag. Look through first-aid kits, side pockets and the like. Try to get members to become more familiar with their equipment and packs.

3.2 Team Equipment

3.2.1 Uniforms

While on a sanctioned function, the searcher shall wear a uniform which has been prescribed by the search organization. When doing public service duties or a teaching function such as a Hug-A-Tree presentation, the uniform may be a search vest, a tee-shirt, a golf-style shirt or a jacket with the team's logo or crest. The team may dictate the color of the uniform. The uniform should identify the wearer as a member of the SAR organization.

On a search or a search exercise, the searcher shall wear clothing which will be visible from a distance and can be easily identified by a missing or lost person(s). It is suggested that this clothing be blaze orange, red or chartreuse in color and shall cover

a minimum of 40% of the searcher's body. Reflective patches may also be added to the clothing to make the wearer more visible at night. This clothing may consist of a simple search vest, a jacket, a jacket and pants or a complete cover-all. There should be some indication that the wearer is a searcher, such as the words *Search and Rescue* prominently displayed on the back, or a team logo or identifying mark.

Some teams may choose to provide their members with a uniform. The member may be required to purchase the uniform from the team, pay a rental fee for the use of the uniform, or post a refundable deposit for the uniform. Other teams may require their members to supply their own uniforms at their own expense.

3.2.2 Personal Protective Equipment (PPE)

The following is a list of basic PPE that should form part of every searcher's equipment carried in the field:

- *Goggles or safety glasses* - to prevent eye injury while moving cross-country during night operations.
- *Footwear* - should include protection of ankles when walking cross-country and may need to be steel toed and puncture proof if searching through a construction site.
- *Rubber gloves and mask* - when dealing with a patient and bodily fluids. May be required when conducting operational assignments following a natural disaster when dealing with a disease outbreak.
- *Leather gloves* – protection against the outdoor elements.
- *Helmet* - to be used in the event of the possibility of head injury.
- *Wide-brim hats* - to prevent sun injury.
- *Sunscreen - to* prevent sun injury.
- *Insect repellent* - to prevent insect bites.
- *First aid kit* - for treatment of personal injury

Further to this list and due to the nature of the activities undertaken in a search situation, it is imperative that the searcher be as safe as possible. To this end, there are several items that may be utilized to protect the individual during a search.

- *Protective eyewear* - these should have high-impact plastic or glass lenses, fit properly and may have side shields to protect the eyes from side-ways pokes. A safety strap may also be utilized to keep the glasses from being knocked off onto the ground.
- *Gloves* - a good pair of gloves will protect your hands from briars, slivers, twigs and the cold, as you make your way through the bush. They may be leather, cloth or wool and should fit properly.
- *Latex or rubber gloves* - you never know when you will be faced with a situation where you don't want to expose yourself to unknown materials. A pair of latex or rubber gloves will offer cheap protection, and are easily carried in a pocket or belt pack.
- *Head lamp* - A good LED headlamp will give the searcher a hands-free method of illumination during a night search, or in a dark location. Most come with several settings, from dim to bright, and will operate for a long time on a single

set of batteries. There are several styles to choose from, including the traditional head-band style to ones which clip onto the brim of a ball cap to ones that have a separate battery pack. Choose the style that best suits your needs.

- *Bear bells* - As we operate in areas where bears may be found, it is important not to surprise one of these animals. Bear bells are an inexpensive way to announce your presence and give the animal time to make its escape, as most bears will try to avoid humans if at all possible.
- *Bear bangers* - if a bear does approach in an aggressive manner, a bear banger is a piece of equipment that can be used to scare it off. A bear banger is a small projectile that is fired from a flare launcher and that will make a very loud bang shortly after it is fired. It is important to aim the banger above the bear, as you don't want the resulting explosion to chase the bear toward you.
- *Bear spray* - another deterrent for bears is bear spray. This is a chemical that comes in a small aerosol can and is directed at the face of a bear. The chemical is an irritant to the eyes and nose, and will provide enough distraction for you to make a hasty escape. Its one disadvantage is that you have to be fairly close to the bear to ensure a good contact with the spray.

3.3 Search Vehicles

OBJECTIVE*:* On a search there often is the need to use vehicles to enhance the effectiveness of the search and the search team. These may include mountain bikes, all-terrain vehicles (ATV) and snowmobiles. Each has its own safety and legal requirements, as well as a list of advantages and disadvantages related to SAR activities.

3.3.1 Mountain Bike

Many SAR teams use mountain bikes. When used on search deployments, there is a list of items that should be carried to ensure the safety and effectiveness of the searcher. Besides the normal search equipment, such as a radio, map, compass and a GPS, the rider should also have:

- First-aid kit.
- Bike repair kit, including suitable wrenches, screwdrivers, a tire repair kit and an extra inner tube.
- Air pump.
- Rain gear.
- Extra clothing appropriate to the weather conditions.
- Food and water.
- Flashlight and head lamp.
- Personal emergency kit.

These items may be carried in a small back pack, or in panniers attached to the bike. As well, the rider should be wearing suitable clothing and safety gear that include:

- Certified cycling helmet.
- Cycling gloves.
- Long pants that can be taped closed at the ankles and worn over cycling shorts to protect the legs if the rider has to go into the bush.
- Brightly-colored shirt or jacket.
- Light hiking boots, rather than cycling shoes. They will be more suitable if the rider has to ford a stream or go into the bush. Boot should fit into cage-style toe retainers on the pedals.

Advantages

- Mountain bikes can cover large distances quickly to check for sign.
- Mountain bikes can transport light equipment easily and quickly (i.e. extra radios).
- Mountain bike-riding emergency responder can reach an area more quickly than if on foot.
- Clues and tracks can be spotted fairly easily from a bike due to the rider's higher profile stance.

Disadvantages

- Mountain bikes cannot travel through thick bush.
- Mountain bikes can erase clues with their tires.
- Mountain biking requires a great deal of stamina, particularly in rugged terrain.

Figure 3-1 Mountain Bike

3.3.2 All-Terrain Vehicle (ATV) and Snowmobile

Depending on the weather conditions, ATV's and snowmobiles may also be used in a search situation. The machine may be owned by the SAR Unit, or privately owned by team members.

In order for a searcher to operate an ATV or snowmobile on a search, they must be a licensed driver and have proper insurance for that vehicle. In addition, the searcher must be wearing an approved helmet at all times when the machine is in motion. Some SAR units may insist that the operator pass a competency test before being allowed to operate a machine on a search.

On a search, the operator must have extra fuel (as required), an emergency tool kit, a personal emergency kit, first aid kit, a means of making a shelter and food and water in case of a break-down, or an over-night stay. Ideally, the machines will operate in pairs, or with two riders. As with any other search team, the operator will be in radio contact with the command post.

An ATV or snowmobile may be used to quickly transport personnel or equipment to a remote location. It may also be used as a radio relay station, as it can be moved around to suitable locations easily and quickly and can respond to an emergency if necessary.

On a search, it is imperative that the operator travels slowly enough to spot clues and does not run over or disturb clues with their vehicle. The machine must be stopped and *turned off* every few hundred meters so the operator can listen for sound clues from the subject or calls from other searchers.

Advantages

- Much faster than a team on foot.
- Covers more territory than a team on foot.
- Can carry much more SAR equipment and personal gear, particularly if equipped with a trailer or sled.
- Creates noise. The sound of these vehicles can carry great distances and may be heard by the missing or lost person(s).
- Does not tire out or require regular rest breaks.
- Can provide transportation to areas not accessible to other types of vehicles.
- Can operate on closed roads or overgrown trails.
- Can reach remote areas faster than any other means of transportation (with the exception of helicopters).

Disadvantages

- Can break down or run out of fuel, requiring a rescue of its own.
- Operator may be distracted from the search by the need to concentrate on driving in rough terrain.
- May travel too quickly to effectively search for signs or clues.

- Creates noise. The operator will be unable to detect possible sound clues from the missing or lost person(s) while the vehicle is running and may miss radio communications from the command post.
- Requires a trained operator to be used efficiently and safely.

Figure 3-2 ATV

3.3.3 Helicopter

In a search situation, a searcher may be required to work around a helicopter, preparing a Landing Zone (LZ), loading or unloading a victim(s), or being transported to or from a search area. It is imperative that searchers are made aware of the unique problems and dangers associated with helicopter operations.

NOTE

The spinning rotor and tail rotor presents an obvious hazard, but the down-draft from the rotor also is a factor that must be addressed.

When entering a helicopter's zone of influence, which is typically a circle with a radius of about 15 meters, there are several things that a searcher must do:

- *First and foremost the member must have a valid reason for entering the zone.*
- Member must have gained permission from the pilot or crew chief.
- Member must have secured or removed all loose items of clothing or gear.
- Member must approach the helicopter from a direction that is visible to the pilot, ideally from the 1 or 11 o'clock position.
- Member must stay low, as the rotor will dip when aircraft not at full power.
- Member must ***not*** hold any equipment or hands above head.

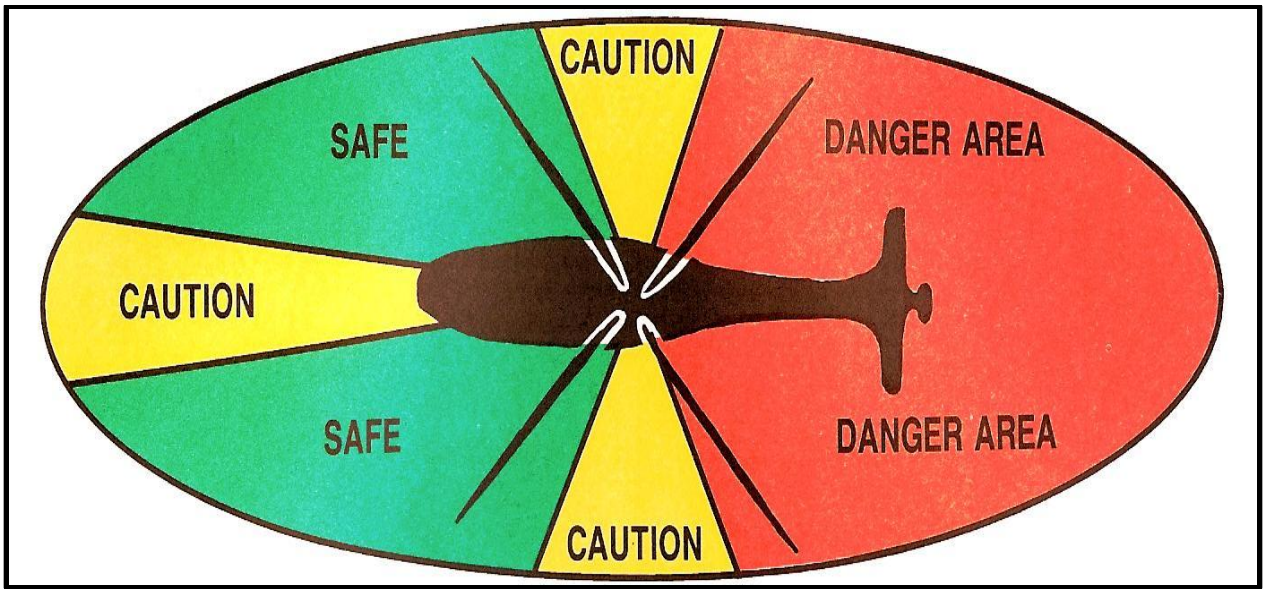


Figure 3-3 Helicopter Danger Areas

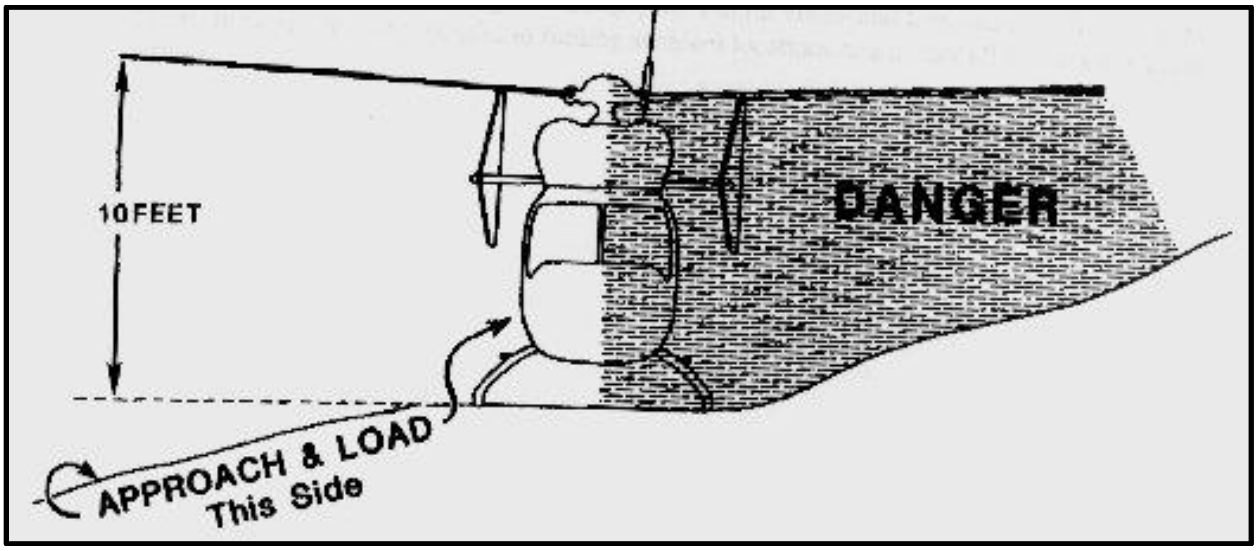


Figure 3-4 Approaching on a Slope

Things to consider when preparing a landing zone for a helicopter are:

- Choose a reasonably flat location.
- Choose an area that is away from overhead wires and other obstructions.
- Choose an area that is free of loose material, or objects over 45 cm in height.
- Choose an area that allows for landing and take-off into the prevailing wind.
- Remove or secure any loose items in the landing zone.
- Wet down the area if possible when dusty conditions are present.

When a helicopter is landing, the team should ensure:

- One person is on the up-wind end of the landing zone and facing the approaching aircraft with arms extended horizontally (marshaller).
- Visual contact with the pilot is vital and maintained at all times when marshaling.
- All other team members *must* remain well back from the landing zone.
- All team members *must* protect themselves from flying debris that could be thrown up by the rotor's down-draft.
- At night, the landing zone may be delineated by light-sticks at the corners and one secured in the middle of the LZ. Never point lights at the approaching aircraft.

Loading a patient - a helicopter provides rapid and effective transportation of a patient to a medical facility. However, weather conditions or terrain may preclude the use of a helicopter, so search teams must plan for alternative methods of transportation.

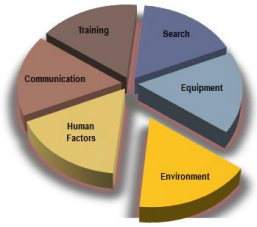
The preferred method of patient transfer is for the helicopter to land and the transfer of causality is directed by the pilot or crew chief. The aircrew may want to have the patient loaded in their litter, so it is wise to check on this (if possible) before securing the patient for transport. The type of helicopter, the style of stretcher and the extent of injuries, may prevent the stretcher being turned on its side, in the event of the patient vomiting during flight, so this must also be a consideration when preparing the patient for transport.

If asked by the crew chief or pilot to assist in loading the patient, the searcher must follow the directions of the aircrew. Do not approach the helicopter without the express permission of the pilot or crew chief. Secure all loose straps and clothing. Approach the aircraft from the 12 o'clock position (*see* ***Figure 3-3 Helicopter Danger Areas***) and keep low.

Figure 3-5 Loading a Patient

Riding in a helicopter - a searcher may be required to ride in a helicopter to accompany a patient, to be transported to a remote search location, or to act as a spotter. Member must pay particular attention to the aircrew safety briefing before boarding the helicopter. Follow the directions of the aircrew when entering or exiting. Once aboard, remain seated with seatbelt secured until directed to do otherwise by the aircrew. Do not touch anything unless given permission to do so. Ensure that all sharp or bulky items are safely secured before take-off. *Enjoy the ride*.

4 Environment



4.1 Weather

OBJECTIVE: It is vitally importance to gain knowledge of weather conditions that have or are likely to prevail in the area of a search prior to, during and in the immediate future. In extremes, this will indicate the possible time frame for the missing or lost person(s) survival but will also inform the team as to what measures need to be put in place to prevent injury.

4.1.1 Weather and its Effects on SAR

Role of team leader - it is the responsibility of team leaders to adapt to the changing weather and know when to rest, stop or turn back. Working outdoors requires planning and preparation. Watch your team members and look out for their welfare.

Actions of searcher - each search must know their limits, the equipment that they have and how best to dress and be prepared for the weather they may be facing. All searchers must inform themselves of the weather situation before leaving their homes and prepare for changes in weather.

What could affect said actions?

- *Searcher* - lack of ability to recognize the specific hazards in the area based on weather and take actions to prevent injury. Unwillingness to face the reality of their limitations and pushing themselves to a point that they become a liability to their team members.
- *Team leader* - same as searcher.
- *Team* - lack of preparation or protocols to deal with Canadian weather while conducting search operations (whether training or operational). Lack of equipment essential to operating in harsh environments.
- *Command post* - same as team.
- *Environment* - train in as many different types of weather conditions within your area of operations. Get to know the natural environment you operate in.

What protocols are in place to address any problems?

- In Ontario there is a wide degree of climatic conditions. All team members need to be able to take action to protect themselves. Members should use and carry sunscreen in both summer and winter when conditions are ripe. All members should wear closed footwear, pants and long sleeved shirts. Hats and leather gloves should be worn to protect against the sun. During wet or rain conditions,

searchers need to have raingear and carry spare clothing. If searchers are to operate in cold weather then they must be dressed for winter conditions.

- All teams need to have up-to-date weather information. Teams when sending searchers out into the environment must be prepared to support them. During hot sunny weather this might include erecting canopy tents for shade and having water to resupply water canteens. During wet conditions, have tents to get searchers out of the elements. Most importantly during the winter would be to set up tents, stoves and lanterns to get searchers out of the cold. Have vehicles, toboggans, snowshoes or skis for teams. Having extra fuel for re-supply of equipment. Finally, teams must have protocols for wind-chill and humidex to ensure that searchers are rested and hydrated during these extreme weather conditions.

4.1.2 Weather Information

Adverse weather prevailing in or approaching an area where survivors are located may also limit the time available to conduct a SAR operation. Not only are survivors of an incident more difficult to detect under adverse weather conditions, but also SAR units themselves operate at lower efficiency due to conditions and higher stresses on the search personnel.

Accurate knowledge of weather conditions and the prudent judgment based on it will enhance the likelihood of a successful mission. Knowledge of the prevailing weather conditions will also play an important role in the safety of the search team.

If weather will not allow for a search operation to be mounted without endangering additional lives, the search effort should be postponed. If weather is currently good but forecast to deteriorate in a short time, more rapid action is required and detailed planning may suffer due to the time available. If weather is good and forecast to remain so, more extensive planning may be accomplished.

Wind, visibility and cloud cover all influence the search spacing of ground personnel. Therefore, the better the weather information, the more realistic will be the derived sweep widths. Maintaining accurate search patterns is difficult in adverse weather.

4.1.3 Weather Information Sources

In Ontario there are many sources of weather information to varying degrees of accuracy. Environment Canada is a national meteorological service which has developed a number of products to inform the public. There at least four different services to stay on top of the changing weather.

- The web-site, *www.weatheroffice.gc.ca* offers up-to the-minute information on current weather conditions, forecasts and warnings for over 800 locations across the country. It also includes satellite and radar imagery, and weather models.
- *Weatheradio*. This network of radio transmitters across Canada provides continuous broadcasts of weather information and instant updates when weather threatens. Local weather conditions, forecasts and severe weather warnings are broadcast over the VHF public service band, reaching over 93% of Canadians.

- *Automated Telephone Answering Devices* provide recordings, in both official languages, of basic public weather conditions, forecasts and severe weather warnings for many large and medium sized cities in Canada.
- *RSS (Really Simple Syndication) and Warning RSS* provide you with timely weather information. Receive weather conditions, forecasts, as well as weather watches and warnings for your city on *Environment Canada's RSS* feed directly on your computer or by cellphone. Wireless access by mobile devices to a suite of weather information has now been added (*www.canada.gc.ca/mobile/wireless-eng.html*).
- Environment Canada has two types of forecasts, a regular forecast which is a detailed 48 hours picture and an extended forecast which covers a 7 day snapshot. Forecasts are issued three times a day at 5:00am, 11:00am and 4:00pm with warnings and advisories issued more often. Forecasts include sky conditions, precipitation, minimum and maximum temperatures, weather events, wind, thermal index and the ultraviolet index.

4.1.4 Storms

Winter storms are large-scale weather systems, hundreds of kilometers across, that are called *extratropical cyclones* because they form and develop outside of the Tropics. These storms gather their energy from the temperature and moisture differences across the boundary where different air masses meet or collide. The larger the differences in the temperature and moisture levels across this boundary, called a front, the more energy there is available for the storms to develop. This is why some are stronger, or more intense, than others.

Winter storms tend to move from west to east and can produce strong winds, heavy snowfall, freezing rain and bitterly cold temperatures as they impact any given area. Winter storms tend to move faster than summer storms.

Environment Canada will issue a *Winter Storm Watch* when conditions are favorable for the development of severe and potentially dangerous winter weather, including:

- A blizzard.
- A major snowfall (25cm or more within a 24 hour period).
- A significant snowfall (snowfall warning criteria amounts) combined with other winter weather hazard types such as:
    - Freezing rain.
    - Rainfall (over coastal BC only).
    - Strong winds.
    - Blowing snow.
    - Extreme wind chill.

A *Winter Storm Warning* when severe and potentially dangerous winter weather conditions are expected, including:

- A major snowfall (25cm or more within a 24 hour period).
- A significant snowfall (snowfall warning criteria amounts) combined with other cold weather precipitation types such as:
    - Freezing rain.
    - Strong winds.
    - Blowing snow.
    - Extreme wind chill.

Blizzard conditions may be part of an intense winter storm, in which case a *Blizzard Warning* is issued instead of a winter storm warning.

Environment Canada will issue a *Blizzard Warning* when winds of 40 km/h or greater are expected to cause widespread reductions in visibility to 400m or less, due to blowing snow, or blowing snow in combination with falling snow, for at least 4 hours.

4.1.5 Lightning

Lightning is the discharge of atmospheric electricity. Thunder is the sound caused by the rapid expansion of air heated by the intensity of the lightning stroke. To estimate the distance of the lightning strike count the seconds after the flash before you hear the thunder and then divide by three to determine the number of kilometers. In Canada on average 10 people are killed and 120 injured annually.

Selected Cities	Average Annual Number of Days with Thunderstorms
Windsor	33
London	31
Toronto	28
Sarnia	28
Kingston	27
Sioux Lookout	25
Kenora	24
North Bay	24
Ottawa	24
Thunder Bay	23
Sudbury	22
Sault Ste. Marie	21
Big Trout Lake	19
Kapuskasing	19
Timmins	19

Table 4-1 Thunderstorms

Environment Canada will issue a *Severe Thunderstorm Watch* when conditions are favorable for the development of severe thunderstorms with one or more of the following conditions:

- Wind gusts of 90 km/h or greater, which could cause structural wind damage.
- Hail of 2cm or larger in diameter.
- Heavy rainfall, as per rainfall criteria, excluding those for winter and during thaw (see above).

A *Severe Thunderstorm Warning* will be issued when there is evidence based on radar, satellite pictures or from a reliable spotter that any one or more of the following three weather conditions is imminent or occurring:

- Wind gusts of 90 km/h or greater, which could cause structural wind damage.
- Hail of 2cm or larger in diameter.
- Heavy rainfall, as per rainfall criteria, excluding those for winter and during thaw (see above).

4.1.5.1 During

Seek shelter immediately when lightning is 5km away or closer. If indoors stay away from windows, doors and fireplaces. Don't use electrical equipment or touch electrical conducting materials like metal pipes. If there is no shelter, crouch down in a ditch or ravine. Don't lie flat; keep your feet together and your head down so as to minimize your exposure of being electrocuted by ground charge. Keep away from power lines, telephone lines, pipelines, fences, trees and hilltops and avoid water.

4.1.5.2 After

Raise communications and establish contact with command post and other teams. Carry out first aid and be prepared to change tasks.

4.1.6 Tornadoes

There are an average of 80 tornadoes reported in Canada each year, most between the months of May and September. Certain areas of the country are more prone to these violent storms, including southern Ontario, south-western Quebec, Alberta, and a band stretching from southern Saskatchewan and Manitoba through to Thunder Bay. In Ontario, few tornadoes have speeds above F3 level. In 1985 a large tornado in Barrie reached the F4 level and caused widespread destruction. There were 12 fatalities, and property losses exceeded $100 million.

Warm humid weather and the thunderstorms that develop when cool northern air masses collide with very warm or even hot air set the stage for the formation of a tornado. What sets it in motion are updrafts and downdrafts in the atmosphere that cause the base of the thunder cloud to rotate.

Tornadoes often appear behind a shroud of heavy rain or hail in a sky that is green, yellow or black. They descend as roaring funnel clouds that can move at speeds of up to 90 km/h. Very large thunderstorms can spawn multiple tornadoes or a single tornado with a number of smaller but intense vortices within it.

Intensity	Estimated Wind Speed	Damage
F0	Light winds of 60 – 110 km/h	Some damage to chimneys, TV antennas, roof shingles, trees, signs and windows.
F1	Moderate winds of 120 – 170 km/h	Cars overturned, carports destroyed and trees uprooted.
F2	Considerable winds of 180 – 240 km/h	Sheds and outbuildings demolished, roofs blown off homes, and mobile homes overturned.
F3	Severe winds of 250 – 320 km/h	Exterior walls and roofs blown off homes, metal buildings collapsed or severely damaged, and forests and farmland flattened.
F4	Devastating winds of 330 – 410 km/h	Few walls, if any, left standing in well-built homes; large steel and concrete objects thrown great distance.
F5	Incredible winds of 420 – 510 km/h	Homes leveled or carried great distances, tremendous damage to large structures such as schools and motels, and exterior walls and roofs can be torn off.

Table 4-2 Tornado

Tornadoes typically snake erratically from southwest to northeast. They can last for a few minutes or a few hours, and usually leave a path of destruction in their wake. The strongest tornadoes, which rank as an F5 on the Fujita Scale, boast winds of just over 500 km/h.

Environment Canada will issue a *Tornado Watch* when conditions are favorable for the development of severe thunderstorms with one or more tornadoes lead time up to 2 hours, but usually much shorter.

Environment Canada will issue a *Tornado Warning* when a tornado has been reported; or when there is evidence based on radar, or from a reliable spotter that a tornado is imminent.

4.1.6.1 During

Seek shelter immediately in a basement. If there isn't one, crouch or lie flat (under heavy furniture) in an inner hallway or small inner room or stairwell away from windows. If there is no shelter lie down in a ditch or ravine, protect your head and watch for flying debris.

4.1.6.2 After

Raise communications and establish contact with command post and other teams. Carry out first aid and be prepared to change tasks.

4.1.7 Rain

Rainfall is included in environment Canada's regular forecasts if the amount is equal or greater than 25mm.

	Location	Greatest Rainfall (mm)	Date
1	Kenora	153.5	1993-Jul-27
2	Thunder Bay	131.2	1977-Sep-08
3	Kingston	128.8	1979-Sep-14
4	Sault Ste. Marie	116.6	1970-May-31
5	Sudbury	112.0	1970-Sep-03
6	Toronto	98.6	1897-Jul-27
7	Barrie	96.0	1995-Jun-02
8	Niagara Falls	95.3	1954-Aug-24
9	Windsor	94.6	2000-Apr-20
10	Ottawa	93.2	1942-Sep-09
11	London	89.1	1986-Sep-29
12	Owen Sound	75.7	1968-Aug-19

Table 4-3 Rainfall

A rainfall warning is issued by Environment Canada when 50mm or more of rain is expected within one hour. In the summer the warning is also issued when 75mm or more of rain is expected within 48 hours. In the winter a rainfall warning is also issued when 25mm or more of rain is expected within 24 hours.

Nothing will lower moral faster than operating outdoors when soaking wet. Not only is there the real dangers of hypothermia (which sets in faster when clothing is wet) but the added discomfort of chafing skin that is wet and blistered feet that are soaking wet. Team leaders need to give searchers time to change socks on the go. Rain jackets and rain pants should be worn depending on the weather and temperature. Teams should have an area to get out of the rain during rests or meals.

4.1.8 Winter – Cold Alerts

Annually 80 Canadians die of over-exposure to cold. No environmental weather condition creates more difficulty for SAR operations then winter. With the cold weather additional personal equipment such as snow shoes, skis may be needed. Additional team equipment such as toboggans, tents, stoves and lanterns will also be needed. The logistics of the search are made more complex as the environment is more taxing on equipment and personnel. The days are shorter which means less daylight for searching and due to snow on the ground all movement becomes more exhausting.

	Location	Lowest Min (°C)	Date
1	Kenora	-43.9	1943-Jan-20
2	Thunder Bay	-41.1	1951-Jan-30
3	Sudbury	-39.3	1982-Jan-10
4	Ottawa	-38.9	1933-Dec-29
5	Sault Ste. Marie	-38.9	1948-Jul-23
6	Barrie	-35.0	1981-Jan-04
7	Kingston	-34.5	1981-Jan-04
8	Owen Sound	-34.0	1979-Feb-18
9	Toronto	-32.8	1859-Jan-10
10	London	-31.7	1970-Jan-24
11	Windsor	-29.1	1994-Jan-19
12	Niagara Falls	-25.0	1943-Feb-15

Table 4-4 Winter Temperature

Teams and members that are operating at a great distance from other teams and command post must have sufficient equipment, food, water and knowledge that they could survive for a night if the weather turns against them.

4.1.9 Winter Warnings

- A *Blowing Snow Warning* is made by Environment Canada when winds of at least 30km/h are expected to reduce visibility to 800m or less for at least 3 hours.
- A *Flash Freeze Warning* is given when significant ice is expected to form on roads, sidewalks or other surfaces over much of a region because of the freezing of residual water from either melted snow, or falling/fallen rain due to a rapid drop in temperature.
- A *Freezing Drizzle Warning* is given when a period of freezing drizzle is expected for at least 8 hours.
- A *Freezing Rain Warning* is issued when freezing rain is expected to pose a hazard to transportation or property; or when freezing rain is expected for at least 2 hours.
- A *Frost Warning* is issued during the growing season when widespread frost formation is expected over an extensive area. Surface temperatures are expected to fall near freezing in the overnight period. This is not a warning for which searchers need to take action but will inform them of conditions of clues for which they might be searching.

4.1.10 Snowfall

Snowfall is included in Environment Canada regular forecasts if the amount is expected to equal or exceed 2cm.

	Location	Snowfall (cm)	Date
1	Barrie	65.0	1995-Jun-02
2	Owen Sound	62.0	1995-Dec-10
3	Sault Ste. Marie	61.0	1947-Feb-10
4	London	57.0	1977-Dec-07
5	Ottawa	55.9	1894-Jan-29
6	Thunder Bay	51.6	1956-Jan-20
7	Toronto	48.3	1944-Dec-11
8	Kingston	46.2	1974-Dec-16
9	Niagara Falls	45.7	1940-Feb-19
10	Sudbury	38.8	1992-Mar-10
11	Windsor	36.8	1965-Feb-25
12	Kenora	36.3	1957-Apr-10

Table 4-5 Snowfall

A *Snowfall Warning* is issued when 15cm or more of snow falls within 12 hours or less.

	Location	Snow Depth (cm)	Date
1	Thunder Bay	179.0	1956-Jan-22
2	Kenora	145.0	1966-Mar-05
3	Sudbury	145.0	1959-Mar-16
4	Sault Ste. Marie	140.0	1995-Dec-12
5	Ottawa	97.0	1971-Feb-24
6	Owen Sound	88.0	1995-Dec-12
7	London	70.0	1977-Dec-10
8	Toronto	65.0	1999-Jan-15
9	Kingston	64.0	1977-Dec-22
10	Barrie	59.0	2001-Feb-09
11	Niagara Falls	47.0	1984-Mar-03
12	Windsor	42.0	1982-Feb-09

Table 4-6 Snow Depth

Snow can be both a hindrance and a help to searchers. In snow areas which are desolate, tracking may be made much easier. If snowfall is recent or occurring it may obliterate clues. Knowing the timeframe of the missing or lost person(s) and recent weather will give searchers some insight into the possibility of finding clues and what condition they might be in.

4.1.11 Wind-Chill

Expressed in temperature and is meant to give an indication of how cold the *chill* that your skin senses without wind. Wind-chill speeds up the rate at which your body loses heat. Knowing the wind-chill enables searchers to take action and avoid injury such as frostbite, and hypothermia.

Environment Canada includes wind-chill values in their regular forecast when the wind speed is greater than 10km/h and the temperature in Ontario in -25ºC.

Wind-Chill	Risk of Frostbite	Other Health Concerns
0 to -9	**Low**	• Slight increase in discomfort
-10 to -27	**Low**	• Uncomfortable • Risk of hypothermia if outside for long periods without adequate protection.
-28 to -39	**Risk**: exposed skin can freeze in 10 to 30 minutes	• Risk of frostnip or frostbite: Check face and extremities for numbness or whiteness. • Risk of hypothermia if outside for long periods without adequate clothing or shelter from wind and cold.
-40 to -47	**High risk**: exposed skin can freeze in 5 to 10 minutes*****	• High Risk of frostbite Check face and extremities for numbness or whiteness. • Risk of hypothermia if outside for long periods without adequate clothing or shelter from wind and cold.
-48 to -54	**Very High risk**: exposed skin can freeze in 2 to 5 minutes*****	• Very High Risk of frostbite: Check face and extremities frequently for numbness or whiteness. • Serious risk of hypothermia if outside for long periods without adequate clothing or shelter from wind and cold.
-55 and colder	**Extremely High risk**: exposed skin can freeze in less than 2 minutes*	• **DANGER!** Outdoor conditions are hazardous

Table 4-7 Wind-Chill

Geographic Area	Wind-Chill	Rating	Impact
Southern Ontario	-25 to -34	cold wind-chill, mentioned in forecast	risk of frostbite
	-35 to -49	very cold wind-chill, warning issued	frostbite in minutes
	-50 or less	extreme wind-chill, warning issued	hazardous frostbite condition
Central Ontario & Southern portion of Northern Ontario	-25 to -44	cold wind-chill, mentioned in forecast	risk of frostbite
	- 45 to -59	very cold wind-chill, warning issue	frostbite in minutes

Table 4-8 Wind-Chill Warning

4.1.12 Prevention and Protection – Cold Shock

Despite all the problems associated with operating in the Canadian winter, SAR teams can be successful in their mission if they stick to the core elements of operating in this environment. All of these actions listed will prevent injury and extend the length of time that searchers can remain on duty.

- *Stay Informed* - listen to the weather forecast before going out. Have a means of continuing to check up on the weather forecast at command post while teams are operating outdoors. Remain in radio contact with all teams and update them if the weather is changing.
- *Plan Ahead* - develop a cold weather safety plan in advance to ensure that safety concerns are addressed when it's very cold, or when the wind chill is significant. For example, arrange in the area you are going to operate to have a location such as a business, schools, community centre or church that searchers could go for schedule warm-up breaks. Set up a window for each team to operate in and as the weather worsens reduce the amount of time they spend outdoors. Have consumable supplies pre-stocked such as fuel, food, water, spare stove generators, lantern mantels and spare clothing. Check first aid kits and survival kits before the winter season.

Threshold Limit Values Work / Warm-Up Schedule for 4 hour shift										
Temp	No noticeable wind		8 km/h Light Breeze		16 km/h Gentle Breeze		24 km/h Moderate Breeze		32 km/h Fresh Breeze	
Sunny day	Max Work Period	No. of Breaks	Max Work Period	No. of Breaks	Max Work Period	No. of Breaks	Max Work Period	No. of Breaks	Max Work Period	No. of Breaks
-26 to -28	Normal	1	Normal	1	75 min.	2	55 min.	3	40 min.	4
-29 to -31	Normal	1	75 min.	2	55 min.	3	40 min.	4	30 min.	5
-32 to -34	75 min.	2	55 min.	3	40 min.	4	30 min.	5	Non-emergency work should cease	
-35 to -37	55 min.	3	40 min.	4	30 min.	5	Non-emergency work should cease			
-38 to -39	40 min.	4	30 min.	5	Non-emergency work should cease					
-40 to -42	30 min.	5	Non-emergency work should cease							
-43 & Below	Non-emergency work should cease									

Table 4-9 Work Threshold Limits

This chart has been adapted based on the American Conference of Governmental Industrial Hygienists as threshold limit values for cold stress, 2008.

Points to remember:

- *Dress warmly* – See Section ***3.1.2 Clothing***.
- *Seek shelter* – See Section ***7.4 Wilderness Survival***.
- *Stay dry* - remove outer layers of clothing or open your coat if you are sweating. To prevent excessive sweating while working, remove clothing in the following order:
- Mittens or gloves (unless you need protection from snow or ice).
- Headgear and scarf.
- Open the jacket at the waist and wrists.
- Remove layers of clothing.
    - As you cool down, follow the reverse order of the above steps.
    - Wet clothing chills the body rapidly so if clothing is socked or a member falls into a creek they must get into dry clothing or into shelter immediately.
- *Keep active* - Walking or running will help warm you by generating body heat.
- *Be aware* - Watch for signs of frostnip, frostbite and hypothermia. Be aware that some people are more susceptible to the cold, particularly children, the elderly and those with circulation problems. The use of tobacco and certain medications will increase your susceptibility to cold.

Alcohol should not be consumed as it causes expansion of blood vessels in the skin (cutaneous vasodilation) and impairs the body's ability to regulate temperature (it affects shivering that can increase your body temperature). These effects cause the body to lose heat and thus increase the risk of hypothermia.

Prevent contact of bare skin with cold surfaces (especially metallic) below -7°C as well as avoiding skin contact when handling evaporative liquids (gasoline, alcohol, cleaning fluids) below 4°C. Sitting or standing still for prolonged periods should also be avoided.

Balanced meals and adequate liquid intake are essential to maintain body heat and prevent dehydration. Eat properly and frequently. Working in the cold requires more energy than in warm weather because the body is working to keep the body warm. It requires more effort to work when wearing bulky clothing and winter boots especially when walking through snow.

Drink fluids often especially when doing strenuous work. For warming purposes, hot non-alcoholic beverages or soup are suggested. Caffeinated drinks such as coffee should be limited because it increases urine production and contributes to dehydration. Caffeine also increases the blood flow at the skin surface which can increase the loss of body heat.

4.1.13 Wind

The *Beaufort Scale* is used to categorize the speed of wind from 0 to 12. Environment Canada will report wind conditions if they are equal or greater than 20km/h. The description of wind is based on a sustained speed.

Scale	Description	Wind Speed	Signs
0	Calm	0	
1	Light Air	1-5	
2	Light Breeze	6-11	Wind felt on face, wind vane begins to move.
3	Gentle Breeze	12-19	
4	Moderate Breeze	20-28	Small flags extended.
5	Fresh Breeze	29-38	Wind raises loose paper, large flags flap and small tree branches move.
6	Strong Breeze	39-49	Small trees begin to sway and large flags extend and flap strongly.
7	Near Gale	50-61	Large branches of trees move, telephone wires whistle and it is hard to use an umbrella.
8	Gale	62-74	Trees bend and walking against the wind is hard.
9	Strong Gale	75-88	
10	Storm	89-102	
11	Violent Storm	103-117	
12	Hurricane	118+	

Table 4-10 Beaufort Scale

A wind warning is issued by Environment Canada when winds are forecasted to be sustained at 70km/h or more sustained wind and or gusts will reach 90km/h or more. Wind will reduce the amount of sound heard in some directions and if searchers are moving into a head wind it will reduce their ability to see clues.

4.1.14 Summer – Heat Alert

Hot weather often brings heat rash or prickly heat, heat cramps, heat exhaustion and heat stroke. Extra water, sunglasses, sunblock, shade and frequent rests are necessary. Searches must be conservative in their estimates of the amount of work they can accomplish. Searchers should be on an assigned rotation policy and where possible have areas the teams can go to cool down. Careful observation is necessary to protect fellow members from heat injuries.

	Location	Greatest Max (°C)	Date
1	Toronto	40.6	1936-Jul-08
2	Thunder Bay	40.3	1983-Aug-07
3	Windsor	40.2	1988-Jun-25
4	Niagara Falls	38.3	1948-Aug-26
5	Sudbury	38.3	1975-Jul-31
6	London	38.2	1988-Jun-25
7	Ottawa	37.8	1913-Jul-04
8	Sault Ste. Marie	36.8	1988-Jul-07
9	Barrie	36.0	1988-Jun-06
10	Kenora	35.8	1983-Jul-14
11	Owen Sound	35.0	2000-Jun-10
12	Kingston	34.3	1983-Jul-15

Table 4-11 Heat Alert

4.1.15 Humidex

Is a Canadian innovation first used in 1965 and describes how hot humid weather feels to an average person. The humidex combines temperature and humidity into one number that reflects perceived temperature.

When searching during high temperature and humidity drink plenty of liquids and take frequent rest breaks. Be sure to maintain salt levels in your body and avoid high-protein foods. Be aware of heat related injuries such as Heat Stroke and be prepared to act. The following table is used by Environment Canada as a value for the Humidex.

Humidex	Degree of Comfort
20-29	No discomfort
30-39	Some discomfort, High
40-45	Great discomfort, Extreme
46 and over	Possible heat stroke, Dangerous

Table 4-12 Humidex

Both the Canadian Centre for Occupational Health and Safety and the Occupational Health Clinics for Ontario Workers Inc. have created the following table to guide employers in the use of the Humidex. This has direct application to SAR teams in Ontario when training or on SAR operations.

Humidex 1	Response	Humidex 2
25 – 29	Supply water to workers on an “as needed” basis	32 – 35
30 – 33	Post Heat Stress Alert notice; encourage workers to drink extra water; start recording hourly temperature and relative humidity.	36 – 39
34 – 37	Post Heat Stress Warning notice; notify workers that they need to drink extra water; ensure workers are trained to recognize symptoms	40 – 42
38 – 39	Work with 15 minutes relief per hour can continue; provide adequate cool (10-15°C) water; at least 1 cup (240 mL) of water every 20 minutes worker with symptoms should seek medical attention.	43 – 44
40 – 41	Work with 30 minutes relief per hour can continue in addition to the provisions listed previously.	45 – 46
42 – 44	If feasible, work with 45 minutes relief per hour can continue in addition to the provisions listed above.	47 – 49
45 or over	Only medically supervised work can continue	50 or over

Table 4-13 Humidex 1 / Humidex 2

Humidex 1, General Controls - General controls apply to un-acclimatized workers and include providing annual heat stress training, encouraging adequate fluid replacement, permitting self-limitation of exposure, encouraging watching out for symptoms in co-workers and adjusting expectations for workers coming back to work after an absence. Workers doing moderate work are considered acclimatized in Ontario only if they regularly work around heat sources (in foundries, around ovens, etc.).

NOTE

Clothing and radiant heat must also be taken into account when using this guideline.

Humidex 2, Job-Specific Controls - Job-specific controls include (in addition to general controls) engineering controls to reduce physical job demands, shielding of radiant heat, increased air movement, reduction of heat and moisture emissions at the source, adjusting exposure times to allow sufficient recovery, and personal protective equipment that provides for body cooling.

4.1.16 Ultraviolet Index

Environment Canada includes information on UV conditions when the index value is greater than 3.

UV Category	UV Index	Notes
Extreme	11 or higher	• Values of 11 or more are very rare in Canada. However, the UV Index can reach 14 or higher in the tropics and southern U.S. • Take full precaution. Unprotected skin will be damaged and can burn in minutes. • Don't forget that white sand and other bright surfaces reflect UV and increase UV exposure.
Very High	8 to 10	• Extra precaution required - unprotected skin will be damaged and can burn quickly.
High	6 to 7	• Protection required - UV damages the skin and can cause sunburn.
Moderate	3 to 5	• Take precaution by covering up, and wearing a hat, sunglasses and sunscreen, especially if you will be outside for 30 minutes or more.
Low	2 or less	• Minimal sun protection required for normal activity. • Wear sunglasses on bright days. If outside for more than one hour, cover up and use sunscreen. • Reflection off snow can nearly double UV strength, so wear sunglasses and apply sunscreen on your face.

Table 4-14 Ultraviolet Index

4.1.16.1 Protection from UV

Reduce the amount of time in the sun if possible, seek shade when outdoors. SAR teams can select shaded areas for rest or erect canopy's to sit under.
Wear broad-brimmed hats, long sleeves and wrap-around sunglasses. Use sunscreen (with both UVA and UVB protection) with a Sun Protection factor (SPF) of 15 or higher.

4.2 Natural Hazards

OBJECTIVE: Although on average, searches may take place after extreme weather events, all searchers need to know what to do if caught up in a natural hazard.

Natural hazards can include the following:

- Flooding
- Landslides
- Fires
- Diseases

4.2.1 Natural Hazards and their Effects on SAR

Role of team leader - ensure team members are aware of these natural risks. Instruct all members about the potential for disease. React quickly to the changing environment and refocus the team when distracted.

Actions of searcher - each searcher must know their limits, the equipment that they have and how best to deal with the variety of hazards faced in the environment. All searchers must inform themselves of the weather situation before leaving their homes and prepare for extreme changes in weather.

What could affect said actions?

- *Searcher* - lack of ability to recognize the specific hazards in the area and take actions to prevent injury.
- *Team leader* - same as searcher
- *Team* - lack of preparation or protocols to deal with extreme weather or environmental hazards while conducting search operations (whether training or operational). Lack of equipment for teams to handle operations in their environments.
- *Command post* - same as team.
- *Environment* - train in as many different types of weather within your area of operations. Get to know the natural environment you operate in. Learn to recognize signs or changes in the environment.

What protocols are in place to address any problems?

- In Ontario there is a wide degree of climatic conditions. All team members need to be able to take action to protect them when faced with extremes. All members must dress for the weather but be capable of adapting to change. During flooding conditions searchers need to have raingear.
- All teams need to have up-to-date weather information not just prior to deploying, but also during. Finally teams must have protocols for extreme weather and know when they are in danger and what to do. Communications must be maintained so that teams can be alerted when a warning is issued. Teams when faced with extreme weather will need to assess their role and whether there response is appropriate to the situation as it develops.

4.2.2 Flooding

Flooding may be caused by overflowing of rivers, lakes and reservoirs due to heavy rainfall, earthquakes, hurricanes and high wind. Flash flooding can occur quickly especially in dry areas where ground is hard or urban areas with large amounts of paved surfaces. Hilly areas are also susceptible to flash flooding as steep topography may funnel runoff into narrow valleys. In areas that have received persistent rainfall or heavy storms, be on your guard in low-lying ground or water channels.

4.2.2.1 During

Seek higher ground. Never cross a flooded area on foot. The fast moving water could sweep an individual away.

4.2.2.2 After

Raise communications and establish contact with command post and other teams. Carry out first aid and be prepared to change tasks.

4.2.3 Landslides

Thousands of landslides occur every year in Canada, but most are small. They occur in all regions but are most damaging in the mountainous regions of British Columbia and Alberta and in the St. Lawrence low-lands of Quebec and Ontario. Large landslides are less common, occurring only about once every 10 years in Canada.

4.2.3.1 During

Move quickly away from its likely path, keeping clear of embankments, trees, power lines and poles. Stay away from the landslide. The slope may experience additional failures for hours to days afterwards.

4.2.3.2 After

Raise communications and establish contact with command post and other teams. Carry out first aid and be prepared to change tasks.

4.2.4 Fires

When out in the woods either for training or search operations, beware of the conditions that create a high risk of forest fire. Drought or long periods of time without sufficient rainfall and high temperatures create conditions that are ripe for forest fires. Wind can create an added risk of spreading and fanning a fire.

The first sign of an approaching forest fire will be the smell of smoke. The sound of the fire’s consumption will be heard before the flames and smoke are seen. Unusual animal behavior will also be an important clue to the approaching forest fire.

4.2.4.1 During

If caught in an area where fire is raging and there is no longer an opportunity to extinguish the flames, do not panic and look at all possible escape routes before fleeing. Look at the smoke and the direction of wind. Fire will be travelling fastest in the direction

of the wind. Rivers provide the greatest possible safe way out of an area. Here are a few possible escape routes:

- If the wind is moving away from you, towards the fire then move into the wind. Head for any natural fire break, river or road.
- If the wind is moving towards you the fire will likely move faster than you can travel on foot. Fire travels faster uphill so do not head for higher ground. If you can't get around the fire seek refuge in a large clearing, deep ravine, watercourse or gulley.
- There might be an escape route through the fire but think wisely. Thick vegetation and forest will burn fiercely. In a clearing it might be possible to move through the flames and into the burned out land. Before you move, cover as much exposed skin and if you have water available dampen clothing. Have a piece of cloth to cover your nose and mouth. Once you decide don't delay or hesitate cover up and run.
- If there is no possibility of getting out of the path of a fire or through and the fire is still some distance away it may be possible to create an area of protection by burning out a patch of ground. With nothing left to ignite the flames cannot advance giving you a refuge. There must be enough time to burn out an area the main fire cannot leap across. You must determine the wind direction correctly so that you don't trap yourself. At least 10 – 100 meters would be best to give you enough space to shelter in.
- If there is no natural gully or depression to shelter in, you may need to scrape a hollow and cover yourself in earth. Use a coat or tarp to hold the earth excavated so that it can be pulled over you. Be aware that beyond the heat and flames suffocation is also a danger.

4.2.4.2 After

Raise communications and establish contact with command post and other teams. Carry out first aid and be prepared to change tasks.

4.2.5 Diseases

After a disaster, diseases will flourish as bacteria, mold and fungus re-establish themselves in disrupted areas. Decay and pollution will cause diseases to spread quickly especially if corpses and animal bodies are left out. Wear masks and rubber gloves. Burn or bury all animal corpses. Boil all water before using.

In the event of a community wide infectious disease outbreak or a pandemic, all SAR teams will need to re-evaluate their positions and roles. Precautions taken will be based on protecting searcher and the needs of the community.

4.2.6 Insects

OBJECTIVE: All searchers must be aware of insect species in Ontario that can cause them harm and what protections exists. Searchers must be able to recognize the symptoms of disease that insects can carry. Searchers must also know what to do if they are faced with a severe allergic reaction.

4.2.6.1 Insects and their Effects on SAR

Role of team leader - ensure team members are aware of these risks and have insect repellent. Instruct all members about the potential for disease and how to recognize symptoms that may not develop until long after an operation or training exercise has taken place. Know which team members have severe allergic reactions to insects and that they know how to administer their own medication. Be aware of members when they are distracted due to the annoyance of insects and stop and refocus the team when needed.

Actions of searcher - know the health risks of insects in Ontario. Dress appropriately and use insect repellent. Avoid contact with poisonous spiders. Follow instructions given. Be prepared to carry out first aid to the level trained. Know what to do if you find a leech or tick attached to a body part or are stung by a bee.

What could affect said actions?

- *Searcher* - lack of ability to recognize specific species of poisonous insect. Distraction due to the annoyance of insects. Lack of knowledge of prevention or treatment of bites.
- *Team leader* - same as searcher.
- *Team* - lack of preparation or protocols to deal with the discovery of poisonous insects while conducting search operations (whether training or operational).
- *Command post* - same as team.
- *Environment* - unfamiliar terrain and vegetation could lead to searchers being poisoned by unfamiliar insect species. Train in as many different types of terrain within your area of operations. Get to know the natural landscape you operate in.

What protocols are in place to address any problems?

- In Ontario there are many biting insects and a few carry diseases or are poisonous. All team members need to be able to take action to protect themselves.
- All members should use and carry insect repellent. All members should wear closed footwear, pants and long sleeved shirts. Pants and sleeve cuffs should be secured to prevent insects from entering. Hats and neck scarf should also be worn in areas of heavy insect populations. Head nets and gloves might also be a necessity while searching in some areas.
- If a member has a severe allergy to an insect bite, they must ensure that their chain of command is aware of the situation. These members must carry medication and alert bracelets while in the field and need to alert their team members to where their medications are kept.
- Render first aid appropriate to your level of training.

4.2.6.2 Mosquitoes (West Nile Disease)

Mosquitoes are abundant, beginning in mid to late May and last longer than blackflies (usually into July). Mosquitoes are most often a problem in cooler, shady parts of the forest, as well as in the evening and into the first couple of hours of darkness. They become less of a problem through the night (although they do not disappear entirely). When outdoors, wear long sleeves and pants, especially during dawn and dusk, and use insect repellent with up to 35% *DEET*.

4.2.6.2.1 West Nile Virus

Since 2001 *West Nile Virus* has been established in Ontario. The disease is transmitted to humans by mosquitoes. Mosquitoes become infected when they bite an infected bird. In 2011 there were 41 cases in Ontario of humans infected with West Nile Virus. There is no way to predict how serious West Nile Virus will be in any given year.

Approximately four out of five people who are bitten by an infected mosquito do not show any symptoms. Of those that show symptoms, most will experience mild illness including:

- Fever.
- Headache.
- Body ache.
- Nausea.
- Vomiting.
- Rash on chest, stomach or back.

Only about 1 in 150 people infected will experience serious symptoms including:

- High fever.
- Severe headache.
- Muscle weakness.
- Stiff neck.
- Confusion.
- Tremors.
- Numbness.
- Sudden sensitivity to light.

Symptoms usually develop between two and 15 days after being bitten by an infected mosquito. Extreme swelling or infection at the site of the mosquito bite is another reason to seek medical attention. This may or may not indicate West Nile Virus infection.

4.2.6.3 Ticks (Lime Disease)

In Ontario, populations can be found in Long Point, Point Pelee National Park, Rondeau Provincial Park, Turkey Point, Prince Edward Point National Wildlife Area and St. Lawrence Islands National Park in the Thousand Islands region of eastern Ontario.

Though closely related to insects, ticks are actually a type of mite. Ticks vary in size and colour; black-legged ticks often referred to as a deer tick, are very small.

When walking in tick-infested areas, wear clothing that will keep ticks from getting to bare skin. Wear closed shoes, long-sleeved shirts that fit tightly around the wrist and tuck them into pants. Protect your legs by tucking pants into socks or boots. Ticks show up better on light-colored clothing.

Insect repellents containing *DEET* are safe and can effectively repel ticks. Check for ticks on clothing and skin after being in tick-infested areas. A daily total-body inspection and prompt removal of attached ticks (within 18 to 24 hours) can reduce the risk of infection. Black-legged ticks are very small, particularly the younger stages, so look carefully. Do not forget to check children and pets as well.

Figure 4-1 Tick

4.2.6.3.1 Tick Removal

Ticks are most effectively removed with a fine pair of tweezers (forceps). Grasp the tick with tweezers as close to skin as possible. The tweezers should be held at a right angle to the main axis of the tick's body. Gently pull the tick away from the host's skin. Avoid twisting or turning the tick during removal as this can cause the tick's mouthparts to break off. When this occurs, it is more difficult to identify the tick to the species level and could cause infection at the feeding site. When appropriate, disinfect the feeding site after the tick is removed. Once removed, immediately transfer the tick to a collection vial. Avoid handling ticks with bare hands. Use disposable gloves, paper toweling or tweezers when transferring ticks to the collection vials. After handling ticks, discard gloves and paper toweling and wash hands and tweezers thoroughly. Have tick tested for Lyme Disease if in doubt.

4.2.6.3.2 Lyme Disease

While it is possible to be bitten by an infected tick almost anywhere in Canada, the chances of this happening in places where tick populations are not established are very low.

The symptoms of Lyme disease usually happen in three stages, although not all patients have every symptom. The first sign of infection is usually a circular rash called erythema migraine (EM). This rash occurs in about 70-80% of infected people. It begins at the site of the tick bite after a delay of 3 days to 1 month. Other common symptoms include:

- Fatigue.
- Chills.
- Fever.
- Headache.
- Muscle and joint pain.
- Swollen lymph nodes.

If untreated, the second stage of the disease can last up to several months and include:

- Central and peripheral nervous system disorders.
- Multiple skin rashes.
- Arthritis and arthritic symptoms.
- Heart palpitations.
- Extreme fatigue and general weakness.

If the disease remains untreated, the third stage can last months to years with symptoms that can include recurring arthritis and neurological problems.

NOTE

Fatalities from Lyme disease are rare.

Contact a doctor immediately if you develop symptoms of Lyme disease, especially when you have been in an area where black-legged ticks are found. If you have saved the tick, take it with you to the doctor's office.

4.2.6.4 Bees (Anaphylaxis)

Bees usually are looking for food, not trouble. But cross their paths, or their nests and you could feel their sting. About 40 people in the United States die from allergic reactions to insect venom each year. After you have been stung once, you can become allergic to that insect's venom. The insects that are most likely to provoke dangerous allergy reactions are classified in the order Hymenoptera (bees, wasps, hornets, yellow jackets). Biting flies, ticks, mosquitoes and spiders also can cause allergic reactions, though they tend to be milder.

4.2.6.4.1 Honeybees

Honeybees, the most common of these stinging insects, aren't aggressive unless provoked. You can recognize them easily by their hairy bodies and bright yellow or black markings. They typically are found around flowers or clover. Once they sting, they die. They often leave their stinger behind.

Figure 4-2 Bee

4.2.6.4.2 Yellow Jackets

Yellow jackets are the most aggressive of the stinging insects. Less chunky than bees and bright yellow with black markings, they hover around garbage and wherever there are exposed foods, particularly those containing sugar. They may sting repeatedly. They nest in the ground.

Figure 4-3 Yellow Jacket

4.2.6.4.3 Hornets

Hornets have short black bodies with yellow or white markings. They nest in trees or bushes and may sting repeatedly.

Figure 4-4 Hornet

4.2.6.4.4 Wasp

Wasps are hairless with narrow "*waists*" that separate their chests from their long, slim, lower bodies. They can be black, brown or red. Wasps build nests under the eaves of buildings and under rafters. They sting repeatedly.

Figure 4-5 Wasp

4.2.6.4.5 Prevention

Of course, the best way to avoid an allergic reaction to insect venom is to avoid getting stung. Keep your distance. If you encounter the insects, slowly back away. Don't swat at them, flail your arms or make sudden movements that could trigger an attack.
Dress for success. Bees, hornets and other flying insects are attracted to bright colors and floral patterns. During picnic season, dress in white, khaki and other light solids, covering as much of your body as possible during late summer and early fall when insect numbers are at their peak. And avoid loose-fitting clothing, as insects can become trapped in it.

Insects also are attracted to smells, so avoid wearing perfume, colognes or other fragrances, including suntan lotion, cosmetics, hair spray and scented deodorant. Outside, wear closed-toe shoes rather than sandals.
Advertise if you're allergic. If you know you are allergic to insect venom, wear a Medic-Alert or other type of medical identification. Many people with insect-venom or food allergies carry a small kit containing a syringe of epinephrine (adrenaline) to inject if they begin to develop signs of an anaphylactic reaction.

Once you've had a severe reaction to a stinging insect, you have about a 60% chance of having another anaphylactic reaction if stung again. Skin tests are used to identify or confirm the insect type that triggered the allergy.

4.2.6.4.6 Symptoms

A sting is never pleasant. Without allergy, a typical reaction is:

- Burning pain.
- Redness.
- Swelling.
- Itching on the skin in the area of the sting.

In an allergic reaction, symptoms are not limited to the area that is local to your sting. A mild allergic reaction may cause symptoms that mimic hay fever, or may produce a rash of puffy pink *hives* or *welts* on parts of the skin that are not near to the sting. Symptoms of a mild allergic reaction could include:

- Runny nose.
- Tearing or itching of the eyes.
- Sneezing.
- A metallic taste in your mouth.

Technically, every allergic reaction that occurs within minutes of exposure is a form of anaphylaxis, but doctors commonly reserve this term to refer to severe allergic reactions. A severe allergic reaction can cause any of the symptoms of mild allergy in addition, it can result in:

- Rapid swelling of your lips or throat.
- Swelling around the eyes.
- Throat tightness.
- Wheezing.
- Difficulty breathing.
- Hoarseness.
- Nausea.
- Vomiting.
- Diarrhea.
- Abdominal pain.
- Light-headedness, or passing out due to low blood pressure.

NOTE

Anaphylaxis is a serious allergic reaction that can be life threatening.

4.2.6.4.7 Treatment

If you get stung by a honeybee, scrape out the stinger with a credit card or a long fingernail. If you try to pull it out, you'll squeeze the venom sac and accidentally release more venom. Scraping it out leaves the venom sac undisturbed.

To ease the pain of a sting, take a pain reliever such as acetaminophen, ibuprofen or aspirin. Children should never be given aspirin because of the risk of *Reye's syndrome*, a rare, but life-threatening illness.

Epinephrine (adrenaline) is the primary treatment for anaphylaxis with no absolute contraindication to its use.

4.2.6.5 Black Widow spider (Poisonous)

The black widow spider's venom is 15 times more poisonous than that of a rattlesnake. But the amount of venom a spider injects with one bite is usually not fatal for humans. The black widow spider is found in warmer regions of the world, up to southern Ontario.

Juvenile spiders are orange, brown and white and acquire their signature charcoal color as they age and molt. Adult females average 8-10mm in length and have a red hourglass mark on their abdomen and one or two red spots over the spinnerets and along the middle of the back. Males are usually about half the body size of the females, but have longer legs. Their joints are orange-brown in the center and black on the ends and they usually have four pairs of red and white stripes on the sides of their abdomen.

Figure 4-6 Black Widow Spider

4.2.6.5.1 Treatment

If a person is bitten by a black widow, seek medical assistance as soon as possible. While waiting for medical assistance wash the bite area with soap and water and elevate the area to prevent spread of the venom. If possible, retrieve the spider and bring it with you to the health care practitioner so that it can be definitively identified. Always seek immediate emergency medical care.

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4.2.6.6 Leeches

Leeches are dark brownish black *worms* with suckers on the end. They are sometimes referred to as *bloodsuckers*. Leeches are slimy parasites that can thrive wherever there is dampness. They can live on land or in water. They are often located in wet forest areas under rocks and logs, swamps, and marshes.

Leeches are attracted to warmth and movement. When a ripple occurs in the water, a leech may make its way toward it attaching to a person's body. You may not even know that a leech has bitten and attached to your body because they release an anesthetic when they bite. Some leeches also release a blood thinner called hiridin to make sucking a person's blood easier.

Figure 4-7 Leech

4.2.6.6.1 Prevention

There are several ways in which you can prevent leeches from attaching to your body. Wear waterproof closed toed footwear with your pant legs tucked into long thick socks when walking through the forest or damp area. You may want to apply petroleum jelly to your legs if you are going to wade in water known to have leeches. Leeches will have a difficult time attaching to and feeding on your legs.

4.2.6.6.2 Removal of Leeches

When removing a leech, it is not recommended that you pull them off as a bigger sore may develop and the area may continue to bleed. Leeches tend to fall off once they are full.

Do not use a lighter or a match to remove a leech as there is a risk of burning the skin. Do not use vinegar, lemon juice, salt, or insect repellent on the leech to remove it. Leeches carry bacteria that can be regurgitated into the host if heat or chemicals are applied.

The optimum way to remove the leech is as follows:

- First use a fingernail to push the head end of the leech off of the skin. It is important to note that the head end is the smaller, skinnier part of the leech, not the larger end. After the head is released, use a fingernail to push the larger end off. Once the leech is removed there will be some bleeding due to the anticoagulant produced by the leech. Cleanse the wound and apply a dressing if required.
- Apply pressure to the area if it continues to bleed. Wash the area with soap and water to prevent infection. Monitor the area for signs of infection such as increased redness, swelling, tenderness or pus-like discharge.

4.2.7 Animals

Objective: All searchers must be aware of the animal species in Ontario that can cause them harm and how to avoid them. Searchers must be able to recognize the symptoms of disease that animals can cause if bitten. They must also know what to do if they are confronted with an animal.

4.2.7.1 Animals and their Effects on SAR

Role of team leader - ensure team members are aware of these risks in the area of animals. Instruct all members about the potential for disease and how to recognize symptoms that may not develop till long after an operation or training has taken place. Be aware of team members, react quickly to an animal encounter and refocus the team once the animal has moved away.

Actions of searcher - know the risks of encountering animals in Ontario. Dress appropriately and carry bear repellent when in bear country. Avoid contact with animals. Follow instructions given and be prepared to carry out first aid to the level trained.

What could affect said actions?

- *Searcher* - lack of ability to recognize specific signs of animals in the area; distractions due to the sighting of animals; member's lack of knowledge of prevention of animal attacks.
- *Team leader* - same as searcher.
- *Team* - lack of preparation or protocols to deal with the discovery of animals while conducting search operations (whether training or operational).
- *Command post* - same as team.
- *Environment* - unfamiliar terrain and vegetation could lead to searchers missing signs of unfamiliar animals. Train in as many different types of terrain within your area of operations. Get to know the natural landscape you operate in.

What protocols are in place to address any problems?

- In Ontario there are many wild animals which can attack, transmit disease or are poisonous. All team members need to be able to take action to protect themselves.

- All members should use and carry bear repellent in bear country. Searchers should wear closed footwear, pants and long sleeved shirts. Leather gloves should be worn to protect against animal bites.
- Render first aid appropriate to your level of training.

4.2.7.1.1 Moose (alces alces)

Males average 1.5 to 2.3 m in height at the shoulders and weigh 400 to 540 kg. There antlers can have a spread of 1.7 m. Despite their massive size, most of the year moose are quiet, solitary and docile herbivores. Starting in late August until early October during mating season, males become aggressive, unpredictable and even crazed.

Figure 4-8 Moose

4.2.7.1.2 Black Bear (ursus americanus)

Bears are smart, curious, powerful and potentially dangerous. They do not like surprises. Bears usually avoid humans and generally you won't see a bear even if one is close by. Remember, you are a visitor in the bear's home range, so do all you can to avoid encounters. Always remember that a bear is faster that you. Bears can run at a top speed of 56 km/h, can climb trees and swim. Bears can smell carrion (meat, flesh, tissue) more than a mile away. They can also hear twice as well as humans. There is an estimated 75,000 to 100,000 in Ontario. Bears roam all over northern and central Ontario, south to Gray, Bruce and Simcoe counties.

Bears emerge between mid-April and early May groggy. It takes two weeks to shake off the hibernation before they start to feed. Eating goes into overdrive from August to October. Depending on the weather, bears will start to bed down in mid-October (northern Ontario) early November (central Ontario). Bears easily wake during hibernation.

Figure 4-9 Bear

Avoid Encounters

- Make noise as you move through wooded areas – especially in areas where background noise is high, such as near streams and waterfalls. Singing, whistling or talking will alert bears to your presence, giving them a chance to avoid you.
- Travel with others if possible.
- Be aware of your surroundings by keeping your eyes and ears open.

- Keep an eye out for signs of bears, such as tracks, claw marks on trees, flipped-over rocks or fresh bear droppings. Immediately report to command post.
- Carry and have readily accessible a whistle or an air horn and bear pepper spray. Know how to use this spray – practice on a stationery object to get the feel for how the canister sprays and to know its limitations.
- Consider carrying a long-handled axe, particularly if you are in "*back country*".
- Avoid strong fragrances that may cause a bear to be curious; put any food you are carrying in sealed containers in your pack.
- While searching the ground, occasionally scan your surroundings to check for bears. If crouching, rise slowly from this position so you don't startle any nearby bears. They may not recognize you as a human when you are in a crouched position.

Whenever you spot or encounter a black bear

- Stop. Do not panic. Remain calm.
- Do not try to get closer to the bear for a better look or picture. Never feed a bear.
- Do not run, climb a tree or swim.
- Quickly assess the situation and try to determine which type of an encounter this might be – chance sighting, surprise or close encounter.
- Always watch the bear but avoid eye contact. While watching the bear, slowly back away until the bear is out of sight.
- If you are near a building or vehicle, get inside as a precaution.
- Stop the search and inform command post.

Types of encounters

- Chance sighting - black bear may:
    - Stand on its hind legs to get a better look at you.
    - Salivate excessively, exhale loudly and make huffing, moaning, clacking and popping sounds with its mouth, teeth and jaws.
    - Lower its head with its ears drawn back while facing you.
    - Charge forward, and/or swat the ground with its paws. This is also known as a bluff charge.
    - Generally, the noisier the bear is, the less dangerous it is provided you don't approach the bear. These are all warning signals bears give to let you know you are too close. When bears are caught off guard, they are stressed, and usually just want to flee.
- Surprise and close encounters:
    - Remain calm. Do not run. Stand still and talk to the bear in a calm voice.
    - Arm your pepper spray.
    - Do not try to get closer to the bear.
    - If the bear does not get closer to you, slowly back away, talking to the bear in a quiet, monotone voice. Do not scream, turn your back on the bear, run, kneel down or make direct eye contact.
    - Watch the bear and wait for it to leave.

- If the bear does not leave or approaches you, yell and wave your arms to make yourself look bigger. Throw objects; blow a whistle or an air horn. The idea is to persuade the bear to leave.
- If you are with others, stay together and act as a group. Make sure the bear has a clear escape route.
- If the bear keeps advancing and is getting close, stand your ground. Use your bear pepper spray (if the bear is within seven meters) or anything else you can find or use to threaten or distract the bear.
- Do not run or climb a tree.

About attacks - Black bear attacks are extremely rare. A black bear may attack if:

- It perceives you to be a threat to it, its cubs or it may be defending food. This is a defensive bear that wants more space between you and it. Such attacks are exceedingly rare although a bear's aggressive display may seem to suggest otherwise.
- It is a predatory bear. These bears are also very rare. Predatory attacks usually occur in rural or in remote areas. Predatory bears approach silently and may continue to approach regardless of your attempts to deter them by yelling or throwing rocks.

What to do if an encounter results in an attack:

- Use your pepper spray.
- Fight back with everything you have.
- Do not play dead except in the rare instance when you are sure a mother bear is attacking you in defense of cubs.
- If you have bear spray:
    - It should be oil based not water based.
    - Have it handy.
    - Do not use as repellent. Use as if it is mace. Do not spray into the wind.
        - Use as a last resort.

4.2.7.2 Wolf (canis lupus), Coyote (canis latrans), Wild Dogs (canis familiaris)

Coyotes are becoming more commonly seen in urban areas as a result of loss of habitat. Encounters between coyote and humans are becoming more common as is the case with wild dogs, and coy dogs. Wolves on the other hand, continue to decline in numbers. As a result they have been put on the species at risk list in Canada, in particular the *Eastern Wolf*, a sub-species of the *Grey Wolf* of which only 2000 are estimated to remain in the wild. Wolf-human interaction is rare and wolf attacks have not been documented in North America.

Figure 4-10 Coyote

Figure 4-11 Wolf

If you encounter a coyote take these immediate steps:

- Respond to its presence aggressively by making yourself appear large; wave your arms overhead, or shove long objects like a walking stick toward the coyote.
- Throw rocks, sticks or other objects to scare it away.
- Carry a whistle and blow it to startle the animal.
- Carry dog spray in areas highly frequented by coyotes.
- Shout in a deep voice and maintain eye contact.
- Do not turn away or run. This may trigger a natural predator/prey instinct and might encourage the coyote to chase after you.
- If the coyote continues to approach, back away slowly and move toward buildings or other human activity.

4.2.7.3 Massasauga Rattler (sistrurus catenatus)

Ontario's only poisonous snake is also on the species at risk list. Adults are not large, ranging from 45 to 75 cm in length but heavy shaped. Its color pattern consists of a grey or tan ground color with a row of large saddle shaped brown black marks down the centre of the back and three smaller rows of alternating spots down each side. Young massasauga rattlers are well-patterned but paler than the adults. This is the only Ontario snake with vertical pupils and cat like eyes. It has heat-sensing pits on each side of its smallish diamond shaped head and its scales are keeled and the tail is stubby with rattle.

Presently, the species remains distributed in sporadic pockets along Georgian Bay and the Bruce Peninsula including Manitoulin Island. In southwestern Ontario, its distribution appears to be restricted to an area near Windsor and the Wainfleet Bog on the northeast shore of Lake Erie.

Massasauga rattlers are active from late April or early May until late October or early November, depending on temperatures. During the remainder of the year they hibernate below the frost line in holes where tree roots penetrate the bedrock; where bedrock is fractured creating rock piles or crevasses; or in rodent burrows. Hibernacula (overwintering sites) are often associated with wetlands or small wet depressions in the terrain.

In the Georgian Bay area, massasauga rattlers use habitats ranging from wetlands to dry upland, mixed coniferous and deciduous forests with bedrock outcrop. They also find these habitats along the shorelines of lakes, streams and rivers and the islands of Georgian Bay.

The massasauga rattler is a sluggish, solitary and passive creature. It prefers to remain motionless hoping not to be noticed. If you come too close, it will rattle a warning. If you see a snake or hear a rattle, stop. Remain still until you know where it is or where the sound is coming from and then move slowly away. The snake may misinterpret a fast motion as a threat. They never pursue people and would rather flee than fight. They do not travel in pairs and cannot jump. They have a short striking distance, about half their body length (approximately 38 cm for a large snake).

Figure 4-12 Massasauga Rattler

4.2.7.3.1 Protection

Wear boots, thick socks and long pants or gaiters when walking where rattlers live. You must also ensure:

- Watch ahead where you are going to step.
- Do not place your hands into places you cannot see. Poke around with a stick when searching underbrush. Use care when picking up pieces of wood or rocks.
- Since their prey is mainly small rodents, their fangs are short and with their limited striking distance they are not much of a threat to humans as long as the aforementioned protective clothing is worn.
- The most common strikes above boot top level occur when a person steps over a snake that is situated on a log or boulder or when they place their hand near the elevated snake.

NOTE

Never pick up a snake until you have positively identified it.

4.2.7.3.2 If Bitten

If bitten remain calm, immobilize or limit the use of the affected limb, get assistance and seek medical attention immediately. If the patient is within 30 to 40 minutes of a medical facility, they should be transported there as quickly as possible. The injured part should

be loosely immobilized in a functional position just below heart level and all rings, watches and constrictive clothing removed.

If the patient will not receive medical attention for some hours, he/she should be placed at rest and treated for shock. The major risk is from the venom being introduced to the heart in a massive dose. Therefore, the slower the heart beats and the less the affected area is exercised, the better. The use of a tourniquet is ***not*** recommended, although some authorities do recommend a restrictive bandage just above the bite to prevent the spread of venom - tight enough to compress the soft tissue, but not tight enough to stop blood circulation.

You should not cut into the bitten area unless you have been specially trained for this - it can cause more damage than the bite itself.

4.2.7.4 Striped Skunks (mephitis mephitis)

Skunk will start with lifting its trail and stamping its feet, arching its back and growling. Skunks if startled or threatened will spray as a last resort. A skunk can shoot 3 to 4m with accuracy. Skunks will attempt to spray in an enemy's eyes. A skunk can spray up to 4 or 5 times. Direct contact with eyes can cause a stinging sensation and even temporary blindness, but this is rare. Skunk spray has no lasting effects and is not poisonous.

Figure 4-13 Skunk

4.2.7.5 Porcupine (erithizon dorsatum)

Porcupines will attempt to flee if threatened but will also resort to the use of their quills. A swat from their tail will embed hundreds of quills. Quills will cause swelling, burn and work their way into the flesh. The most common attack from porcupine is on family pets. Porcupines are nocturnal.

Figure 4-14 Porcupine

4.2.7.6 Rabies

Rabies is a viral disease that affects the central nervous system of warm-blooded animals, including humans. Rabies is transmitted through saliva, primarily via bite wounds. It can also be spread when infected saliva comes into contact with a scratch, open wound or the mucous membranes of the mouth, nasal cavity or eyes. However, human rabies deaths are rare in North America. Prompt treatment following exposure to or a bite from an animal suspected of having rabies can prevent human illness.

The following actions are recommended:

- Immediately wash the wound or exposed surface with soap and water.
- Remove any clothing that may have been contaminated.
- Seek medical attention as soon as possible.

4.2.8 Plants

Objective: All searchers must be aware of the plant species in Ontario that can cause harm. Searchers should also know what to do if they are faced with a poisoning scenario.

The following are the 15 species of plants in Ontario which cause a reaction if touched and should be known to all searchers:

- Canada nettle (*laportea canadensis*)
- False ragweed (*iva xanthifolia*)
- February daphne (*daphne mezereum*)
- Giant hogweed (*heracleum mantegazzianum*)
- Leatherwood (*dirca palustris*)
- Motherwort (*leonurus cardiaca*)
- Wild Parsnip (*pastinaca sativa*)
- Petty spurge (*euphorbia peplus*)
- Pink lady's-slipper (*cypripedium acaule*)
- Poison ivy (*rhus radicans*; synonym *toxicodendron radicans*)
- Poison sumac (*rhus vernix*; synonymy *toxicodendron vernix*)
- Showy lady's-slipper (*dypripedium reginae*)
- Sneezeweed (*helenium autumnale*)
- Stinging nettle (*urtica dioica*)
- Yellow lady's-slipper (*cypripedium calceolus*)

4.2.8.1 Plants and their Effects on SAR

Role of team leader - ensure team members are aware of this risk and protocols. If poisonous plants are encountered, ensure a wash station is set up and have all boots washed in strong soapy water. Instruct all members exposed to wash clothes separately from others in their household and run washing machines through an empty wash cycle once completed. Ensure that all searchers know what to do if a casualty is suspected of suffering from having been poisoned by a plant.

Actions of searcher - know how to recognize common poisonous plants in Ontario. Dress appropriately. Avoid contact with poisonous plants. Follow instructions given. Know how to contact the Ontario Poison Centre and what information they will need. Be prepared to carry out first aid to the level trained.

What could affect said actions?

- *Searcher* - lack of ability to recognize specific species of poisonous plants.
- *Team leader* - same as searcher.
- *Team* - lack of preparation or protocols to deal with the discovery of poisonous plants while conducting search operations (whether training or operational).
- *Command post* - same as Team.
- *Environment* - Unfamiliar terrain and vegetation could lead to searchers being poisoned by unfamiliar plant species. Train in as many different types of terrain within your area of operations. Get to know the natural landscape you operate in.

What protocols are in place to address any problems?

- In Ontario there are over 70 plant species that are poisonous if eaten and at least 15 that cause skin ailments. All team members need to be able to recognize common poisonous plants and avoid them.
- No team members should eat any plants found outdoors while on a search. All members should wear closed footwear, pants and long sleeved shirts. They should wear leather gloves.
- Upon discovery of a person suspected of poisoning from a plant, berry, seed, bulb or wild mushroom do the following:
    - Immediately call the Ontario Poison Centre (1800 268 9017 or 416 813 5900) and be prepared to give the following information:
        - Any symptoms of illness being displayed.
        - Name of plant (if you know it). The specialists at the Centre are specialists in poison Information, they are not plant specialists. They cannot identify plants over the phone.
        - How much and what parts were eaten?
        - How recently it was eaten or touched?
        - Age and weight of the casualty.
- Render first aid appropriate to your level of training.

4.2.8.2 Canada Nettle (laportea canadensis)

(Also known as Canada Lettuce, Canada Woodnettle) Canada nettle is found in moist woods and along streams. This plant has stinging hairs on the leaves and stem that readily penetrate thin-skinned areas on humans. The tips of the hairs break off, allowing the contained liquid to penetrate the body. Intense localized itching results. Applying water to the surface of the affected area can increase the sensation; this problem may persist for several weeks. Avoid this plant if possible.

Figure 4-15 Canada Nettle

4.2.8.2.1 Description

This plant grows to a height of 30 to 150cm, and in small clumps. It has whitish green flowers, produced from spring to early fall.

4.2.8.2.2 General Symptoms of Poisoning

- Erythema (abnormal redness of the skin).
- Itchiness.
- Pain.
- Skin flushed.

4.2.8.3 False Ragweed (*iva xanthifolia*)

(Also known as burweed marshelder, carelessweed, giant marshelder, giant sumpweed, horseweed, marshelder, rag sumpweed) False ragweed is a native herb found across southern Canada in moist areas such as shores or disturbed sites. The plant can cause dermatitis in sensitive humans after they come in contact with the leaves.

Figure 4-16 False Ragweed

4.2.8.3.1 Description

The Plant 150cm in height, un-branched, coarse forb; stems smooth toward the bottom. The Flower had a head green to cream, no rays, no bracts; inflorescence with many, mostly stalk less heads (3.9cm long), large, branched clusters; blooms Aug to Oct. The leaf - upper might become alternate; long-stalked, very widely oval, doubly toothed, roughly hairy on the top, softly fuzzy and light green on the bottom.

4.2.8.3.2 General Symptoms of Poisoning

- Erythema (abnormal redness of the skin)

4.2.8.4 February Daphne (*daphne mezereum*)

(Also known as paradise plant) February Daphne is an ornamental shrub that grows across southern Canada. This shrub and other *Daphne* species are poisonous to humans. The plants contain irritant chemicals that cause pain, burning, and tingling sensations on exposed skin. These sensations are intensified on mucous membranes in the mouth, throat and stomach after ingesting the fruits. More serious symptoms also occur in humans, including kidney damage, which may lead to death. With the exception of February Daphne, the other *Daphne* species and cultivars are found only as ornamental plants in the more southerly and temperate parts of Canada. February Daphne is naturalized in several eastern provinces.

Figure 4-17 February Daphne

4.2.8.4.1 Description

It is a deciduous shrub growing to 1.5m tall. The leaves are soft, 3-8cm long and 1-2cm broad, arranged spirally on the stems. The flowers are produced in early spring on the bare stems before the leaves appear. They have a four-lobed pink or light purple (rarely white) perianth 10-15mm in diameter and are strongly scented. The fruit is a bright red berry 7-12mm in diameter.

4.2.8.4.2 General Symptoms of Poisoning

- Abdominal pains
- Breathing, labored
- Convulsions
- Death
- Diarrhea
- Dysphagia (difficulty in swallowing)
- Gait, staggering
- Hoarseness
- Kidney failure
- Mouth, irritation of
- Muscle twitching
- Prostration
- Temperature, elevated
- Thirsty
- Vomiting

4.2.8.4.3 Notes on Poisoning

Human poisoning by the *Daphne* species can include minor irritation of the mouth region including pain, burning, and tingling. If the plant material is also chewed and ingested, more severe symptoms occur, including bloody diarrhea, abdominal pains, vomiting, and convulsions. In severe cases, prostration, hallucinations, shedding of the lining of the oral and mucous membranes and renal damage can occur. In one case, a child died in Nova Scotia after ingesting berries. Ingestion may lead to muscular twitching and somnolence (drowsiness) which persists for days. Few cases of poisoning actually occur, but the consequences of ingestion can be serious.

4.2.8.5 Giant Hogweed (heracleum mantegazzianum)

Also known as cartwheel-flower, wild parsnip, wild rhubarb, giant cow parsnip, or giant cow parsley) Giant Hogweed is naturalized in south central Ontario. It has caused photosensitization in children after exposure to the plant followed by sunlight. This plant has also been introduced into New York State, where children have also contracted dermatitis from it.

Figure 4-18 Giant Hogweed

4.2.8.5.1 Description

It typically grows to heights of 2 to 5m. Giant Hogweed has a stout, dark reddish-purple stem and spotted leaf stalks that are hollow and produce sturdy bristles. Stems vary from 3 to 8cm in diameter, occasionally up to 10cm. The stem shows a purplish-red pigmentation with raised nodules. Each purple spot on the stem surrounds a hair and there are large, coarse white hairs at the base of the leaf stalk. The plant has deeply incised compound leaves which grow up to 1 to 1.7m in width.

Giant Hogweed flowers in its final year (5th to 7th year) from late spring to mid-summer, with numerous white flowers clustered in an umbrella-shaped head that is up to 80cm in diameter across its flat top.

4.2.8.5.2 General Symptoms of Poisoning

- Blistering
- Erythema (abnormal redness of the skin)
- Brown pigment of skin

4.2.8.5.3 Notes on Poisoning

Symptoms of phytophotosensitization include serious and extensive weeping blisters. The lesions often occur in a line where the person has brushed aside the stems. The bullae can be massive and irritating, and brown pigmentation may remain for years after healing.

4.2.8.6 Leatherwood (dirca palustris)

(Also known as eastern leatherwood, moosewood) Leatherwood is a native shrub found in parts of eastern Canada in woodlands. This shrub contains unknown poisonous chemicals that are most potent in the bark. Chewing the bark can cause severe burning in the mouth and can produce a nauseating taste; dermatitis can occur, especially during flowering and fruiting time.

Figure 4-19 Leatherwood

4.2.8.6.1 Description

Leatherwood is a shrub that grows to a maximum height of about 3m. It is native to the eastern half of North America but uncommon, found in rich woods, and is occasionally cultivated. It is often hard to recognize because the flowers, which come out just before leafing, last a very short time.

4.2.8.6.2 General Symptoms of Poisoning

- Blistering
- Irritation of the mouth.

4.2.8.7 Motherwort (leonurus cardiaca)

(Also known as Throw-wort, Lion's Ear, and Lion's Tail) Motherwort is a naturalized herb that is weedy in flower and fruit gardens. This plant can cause dermatitis in sensitive individuals. Fragrant, lemon-scented oil can cause photosensitivity when ingested.

Figure 4-20 Motherwort

4.2.8.7.1 Description

Motherwort has a square stem and opposite leaves. The leaves have serrated margins and are palmate lobed with long petioles; basal leaves are wedge shaped with three points and while the upper leaves are more latticed. Flowers appear in leaf axils on the upper part of the plant. It blooms between June and August. The flowers are small, pink to lilac in colour, often with furry lower lips. The plant grows to about 60 to100cm in height. It can be found along roadsides and in vacant fields and other disturbed areas.

4.2.8.8 Wild Parsnip (pastinaca sativa)

Wild Parsnip is a cultivated and a naturalized herb in much of Canada. The plant juices can cause photo dermatitis in some individuals after exposure to sunlight. Exposure to leaves, stems, and peeling roots can cause the problem as well. The edible roots contain enough furocoumarins to be physiologically active in some cases. These toxins are mutagenic (even in the dark) inducing melanization in human skin. Photo dermatitis from this plant is often confused with poison-ivy dermatitis.

Figure 4-21 Wild Parsnip

4.2.8.8.1 Description

Wild Parsnip is a member of the Umbelliferae (parsnip) family. Not to be confused with Queen Anne's Lace, which is a white flower. Rosettes grow close to the ground and bear leaves averaging 15cm in height. The plant has a long, thick taproot, which is edible. Flowering plants produce a single, thick stem that contains hundreds of yellow umbellate flowers. The lateral flowers often overtop the terminal flowers. Depending on the habitat and growing conditions, individual flowering plants range to over 120cm in height. Leaves are alternate, pinnately compound, branched and have saw-toothed edges. Each leaf has 5 to15 ovate to oblong leaflets with variable toothed edges and deep lobes.

4.2.8.8.2 General Symptoms of Poisoning

- Blistering
- Erythema (abnormal redness of the skin)

4.2.8.9 Petty Spurge (euphorbia peplus)

(Also known as Radium Weed or Cancer Weed) Petty Spurge is a naturalized herb found across Canada. This plant contains a caustic and irritant chemical in the latex (sap), which causes burning and inflammation of skin and eyes. Ingestion results in complications.

Figure 4-22 Petty Spurge

4.2.8.9.1 Description

It is an annual plant growing 5 to 30cm tall (most plants growing as weeds of cultivation tend towards the smaller end), with smooth hairless stems. The leaves are oval-acute, 1 to 3cm long, with a smooth margin. It has green flowers in three-rayed umbels. The glands, typical of the euphorbiacae, are kidney-shaped with long thin horns.

4.2.8.9.2 General Symptoms of Poisoning

- Discharge from eye
- Irritation of mouth

4.2.8.9.3 Notes on Poisoning

Skin and mucous membrane irritation result from contact with the latex (sap). Severe eye irritation also occurs.

4.2.8.10 Pink Lady's-Slipper (*cypripedium acaule*)

(Also known as lady's-slipper orchid, moccasin flower) Pink Lady's-Slipper is a native perennial orchid that grows across most of Canada. The plant can cause severe dermatitis in some individuals, as do the other *Cypripedium* spp, upon contact with the glandular hairs on the leaves and stem.

Figure 4-23 Pink Lady's-Slipper

4.2.8.10.1 Description

Unlike most other members of Cypripedium, the pouch of Pink Lady's-Slipper opens in a slit that runs down the front of the labellum rather than a round opening. The plant consists of two plicate leaves near the ground. From between those leaves sprouts a long, pubescent stalk that bears a single pink flower. The sepals and petals tend to be yellowish-brown to maroon with a large pouch that is usually some shade of pink but can range from nearly magenta to pure white.

4.2.8.10.2 General Symptoms of Poisoning

- Blisters, weeping

4.2.8.11 Poison ivy (r*hus radicans)*

Poison ivy is a native shrub or vine found throughout southern Canada. Three recognized varieties are found in various parts of the country. Urushiol is the allergenic agent found in most parts of the plant. Damage to plant tissues causes the nonvolatile chemicals to be exposed. Humans are often sensitized, with symptoms ranging from mild itchiness and redness to severe oozing lesions with fever. Poison ivy is probably responsible for more cases of plant dermatitis in Canada than any other plant. Urushiol can contaminate clothes, tools and can subsequently develop dermatitis from contact. Humans do not contract the dermatitis on first contact, but most people are sensitized the first time.

Figure 4-24 Poison Ivy

4.2.8.11.1 Description

The leaves of poison ivy are arranged in threes and almond-shaped. Leaf colour ranges from light green (usually the younger leaves) to dark green (mature leaves), turning bright red in fall; though other sources say leaves are reddish when expanding, turn green through maturity, then back to red, orange, or yellow in the fall. The leaflets of mature leaves are somewhat shiny. The leaflets are 3 to 12cm long, rarely up to 30cm. Each leaflet has a few or no teeth along its edge, and the leaf surface is smooth. Leaflet clusters are alternate on the vine, and the plant has no thorns. Vines growing on the trunk of a tree become firmly attached through numerous aerial rootlets. The vines develop adventitious roots, or the plant can spread from root crowns. The milky sap of poison ivy darkens after exposure to the air.

Poison Ivy flowering occurs from May to July. The yellowish or greenish-white flowers are typically inconspicuous and are located in clusters up to 8cm above the leaves. The berry-like fruit, a drupe, mature by August to November with a grayish-white colour. Fruits are a favorite winter food of some birds and other animals. Seeds are spread mainly by animals and remain viable after passing through the digestive tract.

The following four characteristics are sufficient to identify poison ivy in most situations:

- Clusters of three leaflets
- Alternate leaf arrangement
- Lack of thorns
- Each group of three leaflets grows on its own stem which connects to the main vine.

Various mnemonic rhymes describe the characteristic appearance of poison ivy:

- *Leaves of three; let it be.*
- *One, two, three. Don't touch me*.
- *Berries white, run in fright*. Or, *Berries white, danger in sight.*
- *Red leaflets in the spring, it's a dangerous thing.* This refers to the red appearance that new leaflets sometimes have in the spring.

NOTE

Later, in the summer, the leaflets are green, making them more difficult to distinguish from other plants, while in autumn they can be reddish-orange.

4.2.8.11.2 General Symptoms of Poisoning

- Blistering
- Weeping blisters
- Erythema (abnormal reddishness of the skin)
- Face, edema (swelling)
- Itchiness
- Pneumonitis (inflammation of the lungs)
- Temperature, elevated
- Tracheitis (inflammation of the trachea)

4.2.8.12 Poison Sumac (rhus vernix)

Poison Sumac is a native shrub or vine found in southern Quebec and southern Ontario. The sap of this plant contains the allergen urushiol. The chemical is released when plant tissue is damaged. Humans are highly sensitive to allergic reaction, although at least one exposure is needed for sensitization. Mild to severe dermatitis can result from exposure to poison sumac.

Figure 4-25 Poison Sumac

4.2.8.12.1 Description

Poison sumac is a woody shrub or small tree growing to 7m in height, with 7 to 13 leaflets per pinnate leaf. These are oval to oblong; acuminate (tapering to a sharp point); cuneate (wedge-shaped) at the base; undulate (wavy-edged); underside is glabrous (hair-less) or slightly pubescent (down-like hair) beneath, and are usually 5-10cm long. Its flowers are greenish, in loose axillary panicles (clusters) 7-20cm long. The fruits are sub-globose (not quite spherical), gray, flattened and about 0.5cm across.

4.2.8.12.2 General symptoms of poisoning

- Blistering
- Weeping blisters
- Itchiness
- Temperature, elevated

4.2.8.13 Showy Lady's-Slipper (c*ypripedium reginae*)

Showy Lady's-Slipper is a native orchid found in eastern Canada. The plant can cause dermatitis in sensitive individuals. The symptoms are similar to those of poison-ivy.

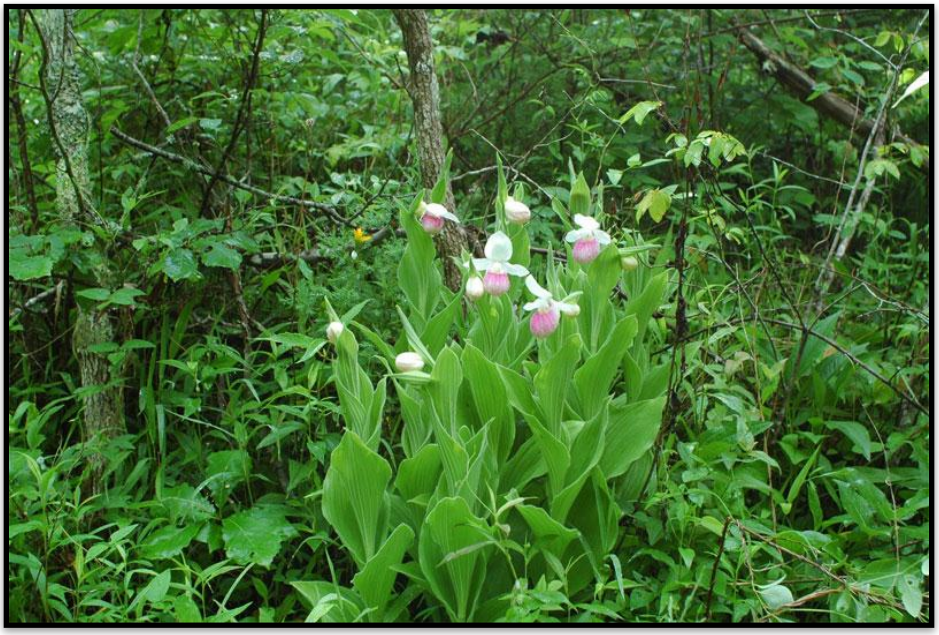


Figure 4-26 Showy Lady's-Slipper

4.2.8.13.1 Description

Showy Lady's-Slipper grows in calcareous wet lands, open wooded swamps, with tamarack and black spruce. Despite growing in mildly acidic environments, its roots can penetrate the mossy layers down to more neutral water sources. It forms clumps by branching of the underground rhizomes. It forms aerial roots in the swampy bog conditions. It is eaten by white-tailed deer.

4.2.8.13.2 General Symptoms of Poisoning

- Weeping blisters

4.2.8.14 Sneezeweed (helenium autumnale)

(Also known as bitterweed, common sneezeweed, fall sneezeweed, false sunflower, mountain sneezeweed) Sneezeweed is a native herb found in parts of central and western Canada. The plant is well-named because it is highly irritating to the nose, eyes, and stomach.

Figure 4-27 Sneezeweed

4.2.8.14.1 Description

Common sneezeweed is cultivated as a garden perennial. There are multiple named varieties varying in color and height. Pumilum Magnificum is a yellow variety about 60cm tall. Bruno, a reddish brown cultivar, Kupfersprudel, which is yellow/orange, and Butterpat, which is golden, all grow 90cm to 105cm tall. Chippersfield Orange is up to 120cm tall and is orange streaked with gold.

4.2.8.15 Stinging Nettle (*urtica dioica*)

(Also known as California nettle, slender nettle, and tall nettle) Stinging Nettle is found across Canada and includes a wide-ranging native subspecies and an introduced subspecies found in the Maritime Provinces. The plant can form large colonies in orchards, farmyards, old pastures, ditches, and waste places. The stinging hairs readily break, allowing the secretions to enter skin. Humans receive a painful sting, followed by small reddish swelling and prolonged itching and numbness. Initial reactions last only a few minutes but repeated contact can cause the pain to intensify and last for days.

Figure 4-28 Stinging Nettle

4.2.8.15.1 Description

Stinging nettle is 1 to 2m tall in the summer and dying down to the ground in winter. It has widely spreading rhizomes and stolon, which are bright yellow as are the roots. The soft green leaves are 3 to 15cm long and are borne oppositely on an erect wiry green stem. The leaves have a strongly serrated margin, a cordate base and an acuminate tip with a terminal leaf tooth longer than adjacent laterals. It bears small greenish or brownish numerous flowers in dense axillary inflorescences. The leaves and stems are very hairy with non-stinging hairs and also bear many stinging hairs, whose tips come off when touched, transforming the hair into a needle that will inject several chemicals. This mixture of chemical compounds cause a painful sting or paresthesia from which the species derives its common name, as well as the colloquial names burn nettle, burn weed, burn hazel.

4.2.8.15.2 Notes on Poisonous Plant Parts

The stinging hairs on the stem, leaves, and flowers produce a painful sting. The hairs consist of a long shaft that narrows towards the point and has a small bulbous tip. The hair just below the tip is not silicified, unlike the rest of the hair, so that the tip is easily broken. A fine hollow shaft that remains can puncture the skin, through which secretions can enter.

4.2.8.15.3 General Symptoms of Poisoning

- Erythema (abnormal reddishness of the skin)

4.2.8.16 Yellow Lady's-Slipper (c*ypripedium calceolus*)

Yellow Lady's-Slipper is a native perennial wild flower found across Canada. The plant causes a type of dermatitis that resembles the dermatitis caused by poison-ivy.

Figure 4-29 Yellow Lady's-Slipper

4.2.8.16.1 Description

The lady's slipper is an orchid. The exotic looking flowers have claret petals that frame a beautiful bright yellow pouch. Each stem usually supports 1 or 2 flowers, but rarely three. The leaves have obvious nerves along their length and are mid-green in colour.

4.2.8.16.2 General Symptoms of Poisoning

- Weeping blisters

4.3 Terrain

OBJECTIVE: Terrain presents the greatest challenge to SAR personnel. Most injuries to SAR personnel are the result to trips, slips and falls. Being ready to be outdoors and dressed for the weather is important but being able to get through difficult terrain and search at the same time is the basis of all SAR work.

4.3.1 Terrain and its Effects on SAR

Role of team leader - to ensure that searchers remain focused of searching while maintaining sight of potential terrain hazards. To stop the team from entering dangerous terrain features if unequipped or untrained. To understand the terrain well enough to make good choices while on the go.

Actions of searcher - to be dressed and equipped to be able to move cross country. To know the limitations of their training and when they are faced with terrain that is beyond their scope of operations.

What could affect said actions?

- *Searcher* - lack of knowledge about the sudden change in terrain. Lack of time to study a map or the change in terrain not reflected on the map. Over focusing on searching to the detriment of not remaining aware of changes in terrain.
- *Team leader* - same as searcher.
- *Team* - lack of preparation or protocols to deal with the discovery of hazardous terrain while conducting search operations (whether training or operational).
- *Command post* - same as team.
- *Environment* - different seasons can mask potential hazards in the terrain. Snow, fallen leaves or fresh growth can obscure mine shafts, well holes and other dangers. Teams should train is as many different terrains are possible and during different seasons.

What protocols are in place to address any problems?

- Each team should understand the limits of their capabilities and train their members to work within these parameters.

4.3.2 Ontario Terrain

Ontario is huge in terms of area - a total of 1,076,395 km^2 making it the fourth largest province or territory in Canada. In 2010 the population was 13,210,667 people making Ontario the most populous but still having a density of 13.8 people/km^2. In reality in 2006 most Ontarians (about 85%) lived in urban areas mostly in the southern region of the province. If Ontario was broken down into the most common lands classes it would look as follows:

- 52% Productive forest
- 18% Water
- 14% Forested wetland
- 9% Wetland
- 5% Field & agriculture (cropland, pasture and natural grasslands)
- 2% Other (urban areas, rock, gravel pits, road corridors and other miscellaneous types)

Two-thirds of Ontario is covered in forest. There are 4 main types of forest:

- Hudson Bay lowland
- Boreal Forrest
- Great Lakes - St. Lawrence Forrest
- The Deciduous Forest

4.3.3 Elevations, Hills, Cliffs

If ropes are required to operate on terrain that has a steep elevation, then this is an area that a team should be operating in with specialized training and equipment. Among the dangers are falls and dislodging rocks. Teams operating in this environment should be wearing helmets and use mountaineering equipment such as ropes, anchors and carabineers that are maintained and inspected. If faced with this type of environment, attempt to find another route and inform the command post of the change in terrain.

4.3.4 Mine Shafts, Caves, Crevices, Wells

This environment is even more dangerous that working with ropes in open elevations. These areas can be unstable and contain pockets of methane gas. Again specialized training such as confined spaces entry and equipment such as gas detectors and man-hoists are required. If faced with this type of environment, attempt to find another route and inform the command post of the change in terrain.

4.3.5 Rivers, Creeks, Moving Water

This environment can change rapidly and despite water appearing calm, can have currents and undercurrents which could catch a searcher off guard and sweep them off their feet. Rivers can have beds that are filled with logs and debris that can easily snag clothing or cause a searcher to trip and fall in. Cold water can quickly sap the strength of a person and white water mask the sound of a searcher in distress.

Searches in rivers require specialized equipment and training. Generally ground search and rescue teams are not prepared for water search and recovery. Teams should limit themselves to shoreline and river bank searches and not enter the water unless they have been trained and are wearing a personal flotation device. Safety must be paramount when close to fast moving water.

If a missing or lost person(s) is suspected to have come into contact with a river, then confinement teams should be deployed down river at a point that is expected to be on the edge of the maximum distance that the river could have swept a person from the search area. Teams should then be deployed to access points along the river on both banks and search not only the banks but a short distance away from the side, in the event that the person who is thought to have entered the river may have exited. The search must be conducted with haste and the first objective should be to locate the person who may be suffering from hypothermia. Once the area has been swept, then a secondary search should take place to search for clues and evidence of entry or exit from the river.

When searching for a possible drowning subject, safety should a priority over haste. Typically a search of this type is a body recovery that involves walking the shore and checking beaver dams, sweepers and other debris collection areas such as against the upstream side of rocks.

Looking into the water can be difficult due to the reflection of light in water. Seek a vantage point that allows the searcher to look down into the water and wear polarizing sunglasses. Teams may have to search a river at different times when water levels have changed. When searching a lake, take note of the wind direction as debris will move to the downwind shore. Currents will also dislodge material and bodies may float to the surface in time.

When travelling cross country and requires crossing a creek, do not enter the water if it is deeper than mid-thigh. Contact command post and inform them that the creek is too deep to cross, study the map and find an alternative crossing point.

4.3.6 Ice

Ice such as frozen rivers and lakes is another environment that requires specialized training, equipment and clothing. Freezing water will quickly kill and where an individual has fallen through, the ice may be unstable and not capable of holding weight. Add to the danger are currents in the water which may not make exiting out of the same hole possible.

During the winter while moving cross country, be aware of the terrain and go around frozen rivers and lakes. Do not walk across ice unless you are certain that a creek is not deeper than your mid-thigh.

If you fall through the ice do not panic. Struggling and groping at the edge will only exhaust you. To escape, extend arms and hands as far as possible up onto the ice, the kick your feet up and extend them to the rear as if swimming. Continue until you slowly work yourself up onto the ice. If you can distribute your weight over the widest possible area and move slowly and deliberately there is a good chance of getting out. Sharp objects might help in gaining a hand hold on the ice. Once on solid ice roll away as far as possible before getting up. If you hear cracking or the ice starts to give, lie down quickly, spread out, and roll away from the area.

4.3.7 Wetland (Pond, Marsh, Bog, Swamp)

This area can be searched by teams with the understanding that when operating in this environment that searchers will need to be looking after their feet if immersed in water for long periods. Members will also need to check for leeches on their bodies. All searchers should have a change of socks. A waterproof layer such as *gortex* socks will help keep searchers stay on task longer so long if the depth of the swamp is not deeper than the height of the socks. Insects will be a particular nuisance during the summer months and head nets and gloves may need to be worn.

4.3.8 Rough Terrain, Ditches, Canals

Areas of land that are clear cut or unused land in urban environments can be a particular challenge to walk through. Ensure that boots are properly laced and providing ankle support. Watch were you are planting your feet and do not shift your weight until it feels solid.

Canals and ditches can be a challenge to cross especially if the sides are steep. Searchers may need to give each other a hand. If travelling in a ditch or canal beware of the danger of flash flooding if the weather has been raining. If the canal system is extensive and needs to be searched, ensure that command post has liaised with the water conservation authority.

4.3.9 Garbage Dumps

Dumps present a danger due to the potential presence of hazardous material, bacteria (e-coli & salmonella), large piles of loose material which present the potential for slips, twisted ankles, unstable surfaces, and cuts from sharp objects and shifting garbage mounds. Searchers should wear masks and rubber gloves and need to take care when moving through material that has been piled up. Searchers should have a change of clothes.

Another danger is the animals that also inhabit the garbage dump including large numbers of birds, in particular gulls, which can be a safety concern along with bears in central and northern Ontario. Gases such as methane are also common on landfill sites

NOTE

No searching should be done without permission from land owners and their advice on safety.

4.3.10 Construction, Industrial Sites

Construction sites can be hazardous due to their state of completion. Walls, floors and ditches may not be secure, nails, boards and building debris may be present. Foot protection against puncture and steel toe caps should be required along with hard hats. Ladders may be needed to access unfinished areas such as basements.

NOTE

No searching should be done without permission from land owners and their advice on safety.

4.3.11 Farmland, Pasture

If entering a field, ensure that gates are left closed. Most domestic animals are for the most part docile but if frightened they may charge, so give animals a wide berth. If entering farmer's fields step carefully and do not crush seedlings. Where possible, move around the field along the outer edge so as not to trample crops.

NOTE

No searching should be done without permission from land owners and their advice on safety.

4.3.12 Gas Pipes Line, Power Lines

There are two types of gas lines found in Ontario, transmission and distribution pipe lines. Transmission pipelines typically range in size from 50.8 to 121.9cm in diameter. Transmission pipe lines carry oil, natural gas, and natural gas liquids from the producing regions of the country to the marketplace. Pipelines delivering natural gas from transmission pipe lines to homes and businesses are distribution pipeline. Distribution pipelines can be as large as 91.4cm in diameter. However, most are much smaller, ranging in size from 3.3 to 16.8cm in diameter. These pipelines generally operate at lower pressures than the transmission pipelines and are owned and operated by local distribution companies. In Urban areas these pipelines tend to be buried. Do not climb on this equipment if there is a danger of rupture (if gas escapes, an explosion could easily engulf an area of hundreds of meters).

Electrical grid uses a similar system of electrical transmission and distribution power lines. High voltage transmission and distribution lines carry a lot of energy or power and if not treated with respect can be fatal. In addition, electrical substations and transformers are fenced, and covered to keep the public away from potential electrical shock hazards.

Electricity seeks the easiest and shortest path to the ground – when people or objects come too close to, or touch an electrical wire, they can become a part of an electrical circuit which can result in an instant flow of electricity through them to ground.

The flow of electricity through the human body can kill – less than one ampere of electricity can burn, severely injure or cause death. Electricity is fast – electricity travels at approximately 299,330 km/sec. That leaves no room for mistakes – never put yourself into electricity's path.

Conductors conduct electricity readily and in large amounts – all metals, water, humans and even non-metallic materials (trees, ropes etc.) can conduct electricity depending on moisture content and surface contamination – caution needs to be applied.

NOTE

Never climb electrical utility poles or towers.

4.3.13 Roads, Highways, Railroads

Extreme care must be taken when searching along a highway due to the speed at which cars are passing and the potential for accidents caused by careless or distracted drivers. Where possible face the traffic. Avoid walking in front of crash barriers. Never attempt to cross a highway unless you have a clear field of view of traffic in both directions. Remember that a car travelling at 120km/h will move 33 m/sec. Be especially cautious around turns and hills. If possible have members further ahead and trailing behind with caution signs.

Trains ***CANNOT*** stop quickly. An average freight train travelling at 100km/h requires about 2 km to stop. A passenger train travelling at 160 km/h requires about the same distance to stop. Compare that to an automobile travelling at 90km/h, which requires about 60m to stop.

NOTE

Railway tracks, trestles, yards and equipment are private property. No searching should be done without permission from land owners and their advice on safety.

4.3.14 Forests

The Hudson Bay Lowlands - the most northerly part of the province, the Hudson Bay Lowlands is an area of subarctic barrens with black and white spruce and willow trees. This forest has a large low relief expanse of wetland, one of the largest in the world. With an area of 26 million hectares, (one quarter of the province and 20% of Ontario's forest), is dominated by both treed and open muskeg (over 2/3 of its area) and is dotted with thousands of small lakes and ponds.

It is generally made up of stunted tamarack and black spruce, growing along river banks and other well-drained areas. The Hudson Bay Lowlands are greatly affected by the cold northern climate and contain all of Ontario's tundra (284,000 hectares). This region is home to woodland caribou, polar bear, arctic fox and arctic hare. During the summer, millions of migratory birds nest here, such as Canada geese, snow geese, willow ptarmigan and various species of sea ducks (see ***Figure 4-30 Ontario Forests***).

Boreal Forest - below the Hudson Bay Lowlands is Ontario's boreal forest, the largest forest region in Ontario and Canada. With an area of 50 million hectares, the boreal forest is Ontario's largest forest region and contains 2/3 of Ontario's forest (58%), extending from the northern limits of the Great Lakes - St. Lawrence forest to the Hudson Bay Lowlands. Here the main conifer species are black and white spruce, jack pine, balsam fir, tamarack and eastern white cedar. The predominant deciduous species are poplars and white birch. These forests are very similar to those in northern Minnesota and parts of upper Michigan.

The terrain of the boreal forest ranges from lowland peat bogs to deep fertile upland soils to bedrock covered by thin layers of soil and moss.

The boreal forest is home to a wide variety of wildlife which include predators such as black bears, wolves and lynx; large ungulates like moose and caribou; a myriad of birds ranging from the great owl to the tiny winter wren, and many small mammals such as the pine marten, varying hare, red fox and porcupine. In addition, the forest contains hundreds of species of plants, such as ferns, mosses, fungi, shrubs and herbs (see ***Figure 4-30 Ontario Forests***).

Great Lakes - St. Lawrence Forest - is the second largest in Ontario, which contains a wide range of tree and shrub species. This forest extends along the St. Lawrence River across central Ontario to Lake Huron and west of Lake Superior along the border with Minnesota. This region covers approximately 20 million hectares of Ontario, 2/3 of which is productive forest. This area contains a mixture of landscapes, plant and animal species. This is a transitional zone between the southern deciduous forest of eastern North America and the predominantly coniferous boreal forest.

In this region, coniferous trees such as eastern white pine, red pine, eastern hemlock and white cedar, commonly mix with deciduous broad-leaved species, such as yellow birch, sugar and red maples, basswood and red oak. Species more common in the boreal forest, such as white and black spruce, jack pine, aspen and white birch also exist here. This forest contains many species of fungi, ferns, mosses and shrubs.

The Great Lakes - St. Lawrence forest region contains 19% of Ontario's forests. The Great Lakes - St. Lawrence forest is home to a wide variety of wildlife, including white-tailed deer, moose, black bear, wolves, pileated woodpecker, various migratory birds, beaver, muskrat, otter and many other mammals, birds, fish and insects (see ***Figure 4-30 Ontario Forests***).

The Deciduous Forest - the deciduous forest is the most southerly and is situated north of Lake Erie. While it has most of the tree and shrub species found in the Great Lakes - St. Lawrence forest, it also contains black walnut, butternut, tulip, magnolia, black gum, many types of oaks, hickories sassafras and red bud–species commonly found in Ohio, Pennsylvania and the Carolinas. Although it covers less than 1% of Canada's land mass, the region is now home to more than 25% of Canada's population.

The early European settlers cleared much of the original deciduous forest because the rich soil and moderate climate of the area were ideal for agriculture. Today, more than 90% of Ontario's 13 million residents live in the south. As a result, this region has largely been cleared with scattered woodlots remaining on sites too poor for agriculture. Efforts to maintain and enhance forest cover in this area have occurred for over 100 years. Tree planting efforts under various programs have converted over 130,000 hectares of abandoned agricultural lands into forest, and an equivalent amount of new forest has been established on private lands through agreements with landowners.

In this region, the forest life is the most diverse in Ontario. A number of nationally rare species of mammals, birds, plants and insects can be found. Some examples are the sassafras and tulip tree, the southern flying squirrel and red-bellied woodpecker. Many species of reptiles and amphibians can also be found in the region, such as the black rat snake, milk snake and gray tree frog (see ***Figure 4-30 Ontario Forests***).

Figure 4-30 Ontario Forests

4.4 Light

OBJECTIVE: As searching is primarily a visual task all searchers must be aware of the role that light plays in assisting or detracting from their ability to locate clues. All searchers must know their own limitations in seeing and seek to improve their skills to overcome their physical deficiencies.

4.4.1 Light and its Effects on SAR

Role of team leader - must know how to promote the best circumstances under which to carry out searches and know how poor lighting conditions may affect the team's results. Encourage night light discipline so that night vision of other members is not degraded by misuse of flashlights, car lights, lanterns and other sources of light in the field.

Actions of searcher – gain confidence in searching in dark situations. Learn to use their senses and keep in mind how light can affect their searching.

What could affect said actions?

- *Searcher* - all members should have red and blue filters that can be placed on their sources of light (flashlights, headlamps, etc.). While using a light beware of team members and do not shine into their eyes. Gain confidence in being outdoors at night and practice seeing in the dark.
- *Team leader* - know your team members and seek to improve their confidence and comfort in the dark. Enforce light discipline so that all members practice and gain confidence in the dark.
- *Team* - practice operating at night with the minimum of artificial light. Equip all vehicles with red lights in particular the command post so that teams when reporting in or going out do not have their night vision spoiled.
- *Command post* - same as team.
- *Environment* - knowledge of when sunset and sunrise is to occur will assist teams in planning. Knowledge of local condition (fog, cloud cover etc.) will also inform search operations. Practice in different locations at night such as forest, urban and moonless nights.

What protocols are in place to address any problems?

- Use of flashlights in the field at night. Necessity of using red filters and all team members having them.

4.4.2 Light and the Eye

There are two types of sensors in the eye, rods and cones:

- Cones function well in brightly lit surroundings; they perceive colour and much detail.
- Rods are far more sensitive than cones, giving night vision with the pupils wide open. Rods do not distinguish colours or see fine detail.

Both rods and cones respond to a wide range of colours, but rods are very insensitive to red light. Rods respond to various colours, but give us a sensation only of black, gray or

white. Rods and cones are distributed non-uniformly across the retina. Cones are only in the centre, while in the periphery, the rods dominate. Thus, the best visual acuity in good illumination is obtained for that part of the image focused on the centre (fovea).

The eye is most sensitive in conditions of weak illumination to images focused off-centre (on the periphery of the retina). Rods are de-sensitized by light very quickly. I can take 20 to 30 minutes to re-sensitize, or dark adapt. If light is needed, yet it is important to keep eyes dark-adapted, then use a red filter on the light. Rods are not sensitive to red light.

4.4.3 Sunlight

There are times and conditions under which searching will be affected by sunlight. While tracking, it will be easier to see the detail of footprints, when the sun is at a low angle, such as early in the morning or late in the afternoon. With a clear sky and a bright sun, search conditions are at an optimum between mid-morning and mid-afternoon when the sun is high.

	Location	Most hours Sunshine Annually	Most hours Sunshine Winter	Most hours Sunshine Fall	Most hours Sunshine Summer	Most hours Sunshine Spring
1	Thunder Bay	2167.74	339.6	379.31	805.8	643.07
2	Ottawa	2061.09	313.0	391.8	776.8	579.5
3	Barrie	2055.1	262.4	402.69	807.7	582.32
4	Toronto	2037.56	273.2	420.02	773.6	570.71
5	Windsor	2027.42	259.0	427.19	794.5	546.74
6	Niagara Falls	2004.97	250.5	402.98	796.4	555.13
7	Kingston	1991.69	289.4	397.15	765.8	539.39
8	Sudbury	1988.85	283.0	350.01	767.9	588.01
9	Owen Sound	1978.59	194.3	367.14	827.3	589.92
10	Sault Ste. Marie	1945.64	242.3	335.36	775.6	592.38
11	Kenora	1923.92	249.9	315.34	762.7	595.97
12	London	1800.03	209.8	360.74	727.3	502.23

Table 4-15 Sunlight

4.4.3.1 Cloud Cover and Sunlight

Clouds, pollution, smoke and haze will affect shadows and how clues are seen. The greater the amount of cloud cover, the less ambient light in the search area. In open areas with little vegetation, the effects will be small, but in denser forests, the effects may reduce the contrasts or visibility of clues dramatically. Haze is particular detriment in the presence of bright sunlight due to the diffusion of light which make seeing clues difficult.

	Location	Greatest No. Fog Days	Most hours Low Visibility Annually	Greatest No. Smoke & Haze days
1	Sudbury	64.4	304.96	35.6
2	London	48.5	200.17	113.0
3	Sault Ste. Marie	44.7	198.69	38.1
4	Owen Sound	36.6	220.37	50.4
5	Barrie	34.3	129.74	59.0
6	Ottawa	33.9	138.73	63.6
7	Thunder Bay	33.0	127.3	14.0
8	Kenora	29.9	140.02	10.3
9	Windsor	29.0	120.37	122.7
10	Toronto	27.0	101.71	82.9
11	Kingston	24.5	134.02	52.1
12	Niagara Falls	10.5	240.93	64.1

Table 4-16 Cloud Cover and Sunlight

4.4.3.2 First and Last Sunlight

The 45 minute periods after sunrise and before sunset are considered unsuitable for daylight visual searching due to the sun's low elevation and resulting lengthy shadows.

These periods are therefore commonly discounted for visual searching at the planning stage, but may be used to move teams to and from search areas, maximizing the time available on scene.

Approximate sunrise and sunset times for Muskoka, Haliburton, North Bay regions of Ontario.

Time	Sunrise	Sunset
Jan-01	7:49 am EST	4:52 pm EST
Jan-15	7:47	5:08
Feb-01	7:37	5:28
Feb-15	7:15	5:50
Mar-01	6:57	6:05
Mar-15	7:30 am DST	7:24 pm DST
Apr-01	7:00	7:45
Apr-15	6:34	8:02
May-01	6:08	8:23
May-15	5:50	8:39
Jun-01	5:35	8:56
Jun-15	5:30	9:07
Jul-01	5:43	9:01
Jul-15	5:52	8:56
Aug-01	6:08	8:39
Aug-15	6:22	8:22
Sep-01	6:38	7:50
Sep-15	6:57	7:28
Oct-01	7:16	6:59
Oct-15	7:32	6:36
Nov-01	7:56	6:07
Nov-15	7:15 am EST	4:50 pm EST
Dec-01	7:36	4:38
Dec-15	7:50	4:36

Table 4-17 First and Last Sunlight

NOTE

For other locations add or subtract the number of minutes as indicated: Kapuskasing +12; Kingston -12; Ottawa -15; Peterborough -5; Sudbury + 6; Thunder Bay + 39; Timmins +8.

4.4.3.3 Down Sun and Up Sun

Down sun is when the sun is behind you. Up sun is when you are facing the sun. Objects are seen at a greater distance when looking down sun as opposed to up sun particularly in early morning or late afternoon. Down sun the glare is absent, haze is more transparent and coloured objects show a marked contrast to their background. Colour contrast is lost when looking up sun, with the result that small objects merge into a confused pattern of glaring light and shadow.

4.4.3.4 Terrain and Sunlight

- *Sandy Areas and Sunlight* - the search of sandy area may need to be suspended during the middle of the day as the sun will bleach out the environment and create mirages which will limit the effectiveness of any search.
- *Forrest and Sunlight* - searches begun early in the day or extending late in the day have a reduced chance of success in wooded terrain due to the shadows cast by the trees and the oblique angle of the sun. These areas are preferably searched when the sun is higher in the sky.
- *Mountain and Sunlight* - likewise because of the sun, mountainsides may be better searched early or late in the day depending on the direction the particular slope faces. A search of the western slopes or steep sided valleys may best be delayed until mid-morning. A search of steep eastern slopes may best be abandoned earlier than 45 minutes before sunset.

4.4.4 Night and the Eye

Due to the physical characteristics of the eye, if an observer looks directly at a small or dim object at night, it may not be seen. To optimize night vision objects there are a number of skills that can be practiced to improve night vision:

- Look for shapes, shadows, contrast and movement.
- Since the centre of the pupil is insensitive, all looking should be toward a side or off-centre. Off-centre (*Averted Vision*) can be achieved by *aiming off* from the object about a fist's width at arm's length. Only by experiment can the searcher find out which direction is most suitable for their aim (above, below, or to one side of the object). It is important that the searcher resist the temptation to look directly at the object.
- Eyes should be kept in motion to keep the rods at their peak of sensitivity. Scanning is the short, abrupt movement of the eye over or around an area of observation or an object that is being kept in view. It is used in conjunction with off-centre vision in order to gain the maximum use of the eyes at night. Therefore, the observer should move their visual axis every 4 to 10 seconds. Night scanning differs from daytime scanning. Should the daytime technique of looking from left to right in overlapping parallel bands from near to far be used, then nothing would be seen.
- Don't stare directly at a sighted object; it will be within your blind spot at night. If the object is lit then staring at it may make the object start to move. This happens because when staring at a stationary light or prominent object in an otherwise black scene the eye has no bearing on which to check the exact position. This can be prevented by placing the object against something else such as a finger at arm's length.
- *Gain confidence*. In order to gain confidence in the ability to see under low light levels, the correct use must be made of the eyes. Objects seen at night tend to be fuzzy and hazy around their extremities. Through practice, an observer must learn to recognize objects at night and how they differ from their daytime appearance. Once a searcher is familiar with the techniques of seeing at night, the confidence necessary for night operations will quickly follow.

- To avoid eye fatigue, every few minutes the observer should close their eyes for a few seconds to allow them to rest.
- *Protecting your night vision*. Any bright light will spoil night vision. It is important that the searcher instinctively closes, or covers one eye when faced with any light at night. In addition they should:
    - Avoid looking at any bright light unnecessarily;
    - Shield the eyes with their hand from flares, spotlights or headlights (by so doing it is possible to see objects moving beyond the lights and it also protect the night vision).
    - Avoid waving flashlights about as not everybody will be quick enough to close their eyes in order to avoid being dazzled.
    - But one hand over the lens when using flashlights to map read, and use the fingers to limit both the area illuminated and the brightness of the light (keep one eye shut and the time spent on reading the map to a minimum).
    - Use of coloured filters on the flashlight to maintain night vision although some details of the map such as red coloured primary roads and urban areas may not be visible in the red light.
    - Remember:
        - Allow eyes to become dark-adapted.
        - Colours are not discernible.
        - Details cannot be seen.
        - Use red light only.

4.4.4.1 Binoculars at Night

One measure of the effectiveness of binoculars for night use is *exit pupil*. This is the diameter of the bundle of light rays exiting toward the eye from the eye-piece of the binoculars. This number is found by dividing the objective lens diameter by the power. For instance, 7x50 binoculars have an exit pupil of 7mm. (7mm is optimal.)
The pupil of the eye is about 7mm when dilated. If the exit pupil is less than 7mm, then not enough information is getting to the eye. (For day use, a small exit pupil is satisfactory, since the eye pupil is only about 2mm in diameter. However the large exit pupil is advantageous because of ease of centering the eye behind the eye-piece).
Using binoculars at night - binoculars should be held aimed straight forward and the eyes turned off centre to avoid using the insensitive centre of the retina. This requires practice, but is very effective.

Practical Exercise
Night vision exercises - set up a training practice on a dark night, no moon, away from city lights. An area with trees, clearings, high areas and trails would be good.

Exercise 1
Without the team members knowing, place 2 people along the trail, one standing, and one lying down. They should not be more than 1.5m from the side of the trail. There should be trees behind them and they should not be hiding. Have them wear non-reflective clothing such as jeans and jacket and not wear a cap or hat. Once the

exercise is underway they must not move or make any noise; that comes later. Advise the searchers that they are not to use their lights once the exercise starts. While the searchers dark adapt, the instructor may conduct a review as to why they are there, what to look for, how to look. Have the searchers walk the trail (stay on the trail) and look around. The instructor will be talking about rods and what to look for, such as, silhouette, movement, etc. Take the searchers past the second person and beyond by about 30m. Advise the searchers that there are 2 people on the side of the trail, and to watch for them on the way back. If a searcher sees 1 of the 2 persons on the trail they should note it and keep it quiet until back at the starting point. Ask if anyone saw a person, and if so, approximately where on the trail. The next trip down the trail should be with the 2 persons at the side of the trail making movement. They should be very easy to spot.

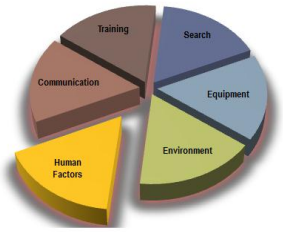
Exercise 2

After that exercise, take the searchers to a small open area where they can see each other with just star light for illumination. (Very occasionally, a person will not be able to see anything. They are night-blind. Most people go through life never knowing. Of several hundred people I've done this exercise with, I've only had 2 who were night-blind.) With their eyes still dark-adapted, have them try to determine the colour of the clothing each person is wearing. Each person can then tell them exactly what colour their clothing is. Have the searchers pick out a distant branch and look directly at it. If it is dark enough, it should disappear. Look at the branch off-center to see it. Ask how far away it is.

Exercise 3

Lights - How close is that light? Well, it depends on the distance, size and strength of the light. Setup another exercise where 1 person, with a collection of flashlights ranging from AAA to 4-D images with white, amber and red filters and a white strobe, will go a distance (recommend 80 to 150m) along a fairly straight trail. This person should disappear completely at normal night vision viewing. The person should have a radio and be coached ahead of time as to what to do. The radio should be turned down so that the searchers can't hear it. The person does not respond on the radio. Advise the students that flashlights will be aimed at them and turned on for one second. Ask the searchers, who are still at the same vantage point, to say out loud how far away they think the flashlight is, what strength it is and what kind of flashlight is being used. Using the radio, prompt for the next and the next until all the flashlights and strobe have been demonstrated. The person with the flashlights should be sure to hold it out in front of him/her and stay away from branches or bush. After round one, give the flashlight person time to (ostensibly) change distance location, and do it again. Of course the person with the lights won't be moving, except changing from one side to another side of the trail to fake the movement once the lights are used again. The searchers will think the flashlight person has moved however, and the results should be interesting. After round two have all the searchers go to where the flashlight person is, and look at the different lights. Which one looked the brightest, the furthest away, destroyed night vision, blinded, and etc. (Did the amber filtered light blind anyone?) It is hoped that this night vision exercise will be of value to the team.

5 Human Factors



5.1 Individual

OBJECTIVE: In this section we will discuss human factors and how they affect the way we search. Awareness of these factors will enable searchers to understand and deal with the issues.

The Human Element:

- We're only human...
- We *will* make mistakes...

The key is to minimize errors, but how? Searchers need to identify their weaknesses and strengths; build on your weaknesses and play to your strengths.

Complacency – defined as, a feeling of contentment or self-satisfaction, especially when coupled with an unawareness of danger, trouble, or controversy.

- "I don't need to train; I've done this a hundred times..."
- "I've been a searcher for over 25 years; I know what I'm doing..."
- Safety Nets
    - Always follow checklist(s) and team protocols.
    - Never work from memory.
    - Be sure to vary your routine periodically.
    - Be aware of the dangers of complacency.

Distraction – defined as, the act of distracting; drawing someone's attention away from something; *conjurers are experts at misdirection.*

- Phone calls
- Personal issues
- Rumours
- Safety Nets
    - Use a detailed checklist and/or follow team protocols.
    - Always finish the task.
    - Double-inspect the work
    - Observe all safety precautions.
    - Document all findings and incidents.
    - If distracted, when you return to the task, always go back 3 steps.

Fatigue – defined as, the body's normal reaction to a physical or mental stress of a prolonged duration.

- There are two types:
  - Acute – short duration; cured with good night's sleep.
  - Chronic – occurs over a long period of time; long recovery.
- Causes of fatigue:
  - Long hours of labor (any type).
  - High-intensity stress.
  - Large temperature variations.
  - Noise –above 80db for long duration.
  - Sufficient intensity vibration for long periods.
  - STRONG lighting.
- Symptoms of fatigue:
  - Enhanced stimulus required in order to respond.
  - Attention reduced.
  - Memory diminished.
  - *Withdrawn* mood.
  - Circadian Rhythm (a daily cycle of activity) inconsistencies.

Norms – defined as, standards, models, or patterns regarded as typical.

- I don't care how you did it there; we've done it *this* way for years!
- Outdated/inadequate team policies/procedures/protocol.
- What are *Norms* exactly?
  - The way of doing business that's not approved, but it's been done locally for so long that it is now a *Norm.*
  - Always work in accordance with the appropriate training manual/team standards, procedures and protocols, or if needed, have these revised.
  - Be aware that *Norms* do not make it right.

Pressure – defined as, a compelling or constraining influence, such as a moral force, on the mind or will: *pressure to conform; peer-group pressure.*

- Pressures can come from a variety of sources, command post, team, family and even self-imposed from the individual.
- Safety Nets:
  - Stop! Assess the situation.
    - Look at the situation rationally.
    - Can I safely do the job?
    - Have I voiced my concerns clearly?
    - What is the worst thing that can happen to me?
  - Listen to your rational mind.
    - Has this happened before?
  - Act.
    - Speak up – ask for help or more time.

Stresses – defined as, mentally or emotionally disruptive or upsetting conditions, occurring in response to adverse external influences and capable of affecting physical health; usually characterized by increased heart rate, a rise in blood pressure, muscular tension, irritability and depression.

- Personal issues.
- Weather/terrain concerns.
- Wanting that recognition from the leaders.
- How to manage:
    - If you do not manage stress, it will gladly manage you.
    - Stop burning up emotional energy.
    - Look rationally at the problem.
    - Cure the cause, not the symptom.
    - Listen to your rational, not your emotional mind.
    - Act - once you have a plan, go for it.
- Other stress helpers:
    - Be sure the solution starts with "I".
    - Be realistic and practical.
    - Take a break.
    - Talk to someone who is not emotionally involved with the situation.
    - Don't expect miracles, just keep trying.

Lack of assertiveness – defined as, the lack of confidence in claiming one's rights or not putting forward one's views.

- *Only do what's expected of me and that's it... Not a movement more*.
- Not researching all applicable SAR training data.
- Not following SAR data to the *T*.
- Safety Nets:
    - Refuse to compromise your standards.

Lack of awareness – defined as, lack of knowledge or cognizance.

- Not aware of SAR data revisions and/or changes in team procedures/protocols.
- Not aware of surroundings.
- Safety Nets:
    - *Think* - *W*hat could occur in the event of an accident?
    - *Check* - Will your actions conflict with your assigned role and team tasking?
    - *Ask* - See if anyone else can spot a problem you overlooked.

Lack of communication – defined as, lack of exchange of thoughts, messages, or information (as by speech, signals, writing or behavior).

- Either searcher to searcher.
- Team leader to team.
- Command post to team.
- Good communication tip:
    - You have:
        - 2 ears.
        - 2 eyes.
        - 1 mouth.
        - Use them in that order!
- To improve communication:
    - Learn to listen.
    - Do not:
        - Debate.
        - Detour.
        - Pre-plan.
        - Tune-out.
    - Do:
        - Ask questions.
        - Paraphrase.
        - Make eye contact.
        - Use positive body language.

Lack of knowledge – defined as, lack of information, facts and/or awareness.

- Am I experienced for this task?
- Do I have all of the appropriate SAR data to gain the required skills?
- Safety Nets:
- Obtain the required basic SAR training.
- Get supervised practical field training.
- Use current SAR training manuals.

Lack of resources – defined as, lack of something that can be used for support or help. Also lack of available supplies that can be drawn on when needed.

- Is the appropriate SAR data available?
- Do I have the proper personal and/or team equipment to perform the task?
- Safety Nets:
    - Ensure that your personal gear is ready when needed. Replenish consumables after each training or search operation.
    - Know your sources.
        - Arrange for pooling and/or loaning.
    - Maintain readiness.

Lack of teamwork – defined as, lack in cooperative work done by a team and/or the inability of individuals to work efficiently as a team.

- Is this a task that really 2 searchers should do?
- No, I don't need any help; I know what I'm doing.
- Safety Nets:
    - Always discuss and plan the Who, What, When, Where, and How of the task to be done.
    - Insure that everyone understands and agrees.

Human factors prevention

- Recap:
    - We're all human and we will make mistakes.
    - Know your limitations.
    - Learn to recognize it in others.
    - Cure the cause and not the symptom!

5.2 Team

What makes a good search and rescue team? Many studies have revealed that individual qualities are required for good teamwork; individuals that are good at:

- *Communicating clearly and precisely.*
  Communication is a key factor in teamwork, simply because misunderstandings are so common. Often a clear message will be distorted in some way upon reception. This occurrence is normal, since none of the human senses are perfect.

- *Accept challenges and know how to respond to them.*
  People who tend to challenge are often considered a problem on a team. This is unfortunate since challenges can be essential to improving teamwork. Of course not all challenges are useful, but some are. Challenging authority or decisions is certainly not always helpful. On the other hand, challenging concepts can minimize the risk of error.

- *Use short term strategies as needed.*
  Short term strategies are defined as plans that are developed to solve a particular problem. Short term strategies should be used, when time permits, to solve any problem that is not covered by team procedures and/or protocols.

- *Have the right balance between authority and assertiveness.*
  Authority is certainly an important component in leading a team. However, finding the right dose of this ingredient is not easy. Using too much authority can be as detrimental to the team as using too little. Assertiveness is also a very important quality, but again finding the right balance is tricky.

- *Manage to find balance between performance and people orientated styles.*
  Management styles of a team leader can have a profound effect on the behavior, performance and well-being of the team.

- *Know how to control their workload.*
  To be efficient you need to be able to control your workload. If you are overloaded, you will probably feel stressed and this will adversely affect your performance. On the other hand, a very low workload will usually draw you into boredom and lack of motivation, which can also translate into lower performance level.

- *Can maintain an adequate level of alertness.*
  This is another factor that may affect the efficiency of the team. If your team gets bored or inattentive, performance will suffer. Stress or panic will also affect your team in the same way.

- *Have sound judgement and usually good decision making skills.*
  Judgement is an aptitude that can be developed. To improve your judgement you need a good decision making process. You also need to know what factors can influence your judgement.

5.3 Handling External Influences

When you are ready to choose a solution to a given situation, you are likely influenced by external factors. Very often these influences or pressures will push you toward a solution that is not ideal. Some common external influences are:

- Economic factors.
- Responsibilities
- General attitude
- Peer pressure
- Physical status
- Hidden pressures

General attitude can seriously affect anyone’s judgment. The following general attitudes are considered dangerous:

- Anti-authority
- Impulsiveness
- Invulnerability or vulnerability
- Excess confidence
- Resignation
- Narrow-mindedness
- Lack of initiative
- Laziness

Hidden pressures are simple pressures that you are not aware of. These pressures usually involve your previous experiences, your fears (conscious or unconscious) and your beliefs (i.e. looking for a child and your child is the same age, or, looking for an Alzheimer patient and your parent is one). Dealing with hidden pressure is not easy. You have to try to identify hidden pressures that may affect you at any particular time. Ask yourself – why am I doing this? Take corrective action to resolve your hidden pressures by answering your own question.

5.4 Critical Incident Stress

OBJECTIVE: Generally define critical incident and common reactions of personnel involved in response to these incidents. Describe and provide awareness on critical incident stress, signs and symptoms, methods of managing stress as it relates to SAR members and define Critical Incident Stress Debriefing (CISD).

5.4.1 Critical Incident

Critical Incident can be defined as any situation faced by leader/members that generate unusually strong emotional impact and can include but not limited to:

- serious injury or death of a Search and Rescue (SAR) member in line of duty
- serious injury or death of a bystander responding to the SAR operation
- multiple deaths or serious injuries
- serious injury or death of a child or infant
- any situation that attracts attention from the media
- any loss of life after prolonged search and rescue efforts
- any circumstance that raise emotion that is beyond normal coping mechanisms of SAR members

5.4.2 Critical Incident Stress

Critical incident stress can be defined as the psychological and physical reaction to a highly distressing event. When at most severe, may result in Post-Traumatic Stress Disorder (PTSD). Some long term consequences of unresolved immediate stress reactions can include but not limited to:

- severe depression, that could lead to suicide
- marital problems, that could lead to divorce
- other psychological disturbances

5.4.3 Signs and Symptoms

OBJECTIVE: Describe and provide awareness on signs and symptoms of critical incident stress to all SAR team members.

After being involved in an intense, unusual, or abnormal event (critical incident), you may experience reactions that are out of the ordinary for you. This is not an uncommon experience. The event may create a stress response which can result in changes in your usual physical or emotional reactions. These reactions are normal. Often they appear immediately after the event, but can also appear hours, days, weeks or months later. Some of the more common reactions reported by individuals after a critical incident may include, but are not limited to:

PHYSICAL*	EMOTIONAL	COGNITIVE	BEHAVIORAL
Nausea	Anxiety	Memory problem	Withdrawal
Intestinal upset	Grief	Poor attention	Restlessness
Fatigue	Guilt	Nightmares	Antisocial acts
Rapid heart	Denial	Intrusive images	Increased suspicion
Chest pain	Fear	Hyper-alertness	Avoidance
Difficulty breathing	Depression	Loss of orientation	Change in speech
Shock symptoms	Panic	Poor problem solving	Change in appetite
Muscle cramps	Apprehension	Poor decisions	Startle reflex
Headaches	Disturbed thinking	Sleep disturbance	Blaming others
Chills	Irritability	Flashbacks	Pacing

Table 5-1 Symptoms

*Any of these symptoms may indicate the need for medical evaluation.

5.4.3.1 Stress Response Syndromes

Immediate Stress Reactions occur at scene or within 24 hours (also known as “acute stress reaction”). May include physical, emotional, cognitive and behavioral components and is the response of a typical person to an atypical situation, and not a sign of any psychological weakness or chronic psychiatric problems.

Physical symptoms can include:

- Profound fatigue and weakness.
- Fine tremor or muscle twitches.
- Excessive sweating (diaphoresis).
- Vasovagal orthostatic hypotension or vasovagal syncope (simple fainting).
- Unfocused, light headedness.
- Nonspecific head ache.
- Trouble focusing one’s eyes.
- Difficulty hearing.

- Palpitations.
- Shortness of breath (dyspnea) and chest pain with or without hyperventilation.
- Nausea, vomiting, diarrhea, or abdominal pain.
- Feeling of lump in throat.

New or inexperienced members may disappear after a search that has caused a strong emotional impact on the team/member. Team leaders in a unit need to be watchful for members that do not return to functions after a difficult search.

Emotional symptoms can include:

- Defensive or generalized anxiety.
- Strong fear or even panic reactions.
- Psychological shock.
- Survivor guilt uncertainty.
- Acute grief reactions.
- Despair.
- Intense or inappropriate emotional reactions to normal occurrences.

Cognitive symptoms can include:

- Blaming others for the critical incident.
- Generalized confusion.
- Lack of concentration.
- Inability to perform simple calculations.
- Reduced attention span.
- Memory lapses.
- Inability to find right words.
- Incapable of distinguishing differences between serious and trivial concerns.
- Inability to make decisions.
- Greatly increased/decreased alertness/awareness of surroundings.

Behavioral symptoms relative to a person's normal behavior patterns and which may vary widely between individuals can include:

- Changes in typical activity patterns.
- Changes in speech patterns.
- Withdrawal.
- Angry out bursts.
- Increased suspicion and attention to one's environment, or even out right. paranoid behavior.
- Changes in relations with others (wife, friends, team members, etc.).
- Increase/decrease in appetite or alcohol consumption.
- Sleep disturbances, including early morning awakening, early insomnia, and generalized fatigue.
- Visits to health professionals for seemingly minor or even nonexistent problems.

Delayed Stress Reactions occur at variable times after stressful incident, often triggered by something that reminds us of first stressful incident. Points to remember:

- More than three weeks of symptoms.
- Symptoms continuous or intermittent.
- Usually from 2-3 days and can extend to 3-4 weeks after incident.
- May last weeks, months, or years.

Symptoms can include:

- Behavioral, cognitive, physical or emotional symptoms as for immediate stress reactions.
- Limited range of emotions.
- Lack of involvement from normal life events.
- Guilt over survival (when others didn't survive).
- Recurring dreams, or disturbing waking images about incident - "flash backs"
- Fear and anxiety, sometimes overwhelming, and for the most part fear of another similar incident.
- Regression (draws back to childish defense mechanisms).
- Avoidance behavior (avoiding conditions/places that remind person of stressful incident).
- Preoccupation with death.
- Sleep disturbances as depicted for immediate stress reactions.

Cumulative Stress Reactions also known as "burnout", occur from mild but unrelenting stress. Members should seek professional medical attention if burnout condition exists.

5.4.4 Stress Management

OBJECTIVE: Describe guidelines in managing stress.

Some guidelines in dealing/managing stress while on a search deployment include:

- Maximum of 12 hour shifts, but keep in mind that sustained SAR stress levels is lower than most disasters; for SAR the 12 hour max is an ideal and not a rule.
- Always brief new arrival personnel, particularly about disturbing sights or smells and what they can expect.
- Those recovering bodies or body parts likely to need early relief.
- For psychological reasons, those dealing with bodies or body parts, even if wearing gloves must have water and soap for hand washing.
- Food: no concentrated sweets as sweets may accentuate stress response, and tend to cause hypoglycemia later; also require large amounts of water for digestion.

- Caffeine and tobacco increase stress reactions:
    - 700 mg of caffeine = 7 cups of coffee and causes primary psychiatric symptoms even if no stress.
    - 2000 mg of caffeine = 20 cups of coffee is fatal dose for adult.
    - Hot cocoa has Theobromine, similar but less potent than caffeine and is good alternative; herbal teas also good.
    - Keep stressed people away from caffeine and nicotine for at least 4 hours.
- Relieve anyone who shows significant changes in behavior.
- May want to ask Critical Incident Stress Debriefing Team to respond to mission early, if likely stressful.
- For any critical incident, all released from base and/or command post area need a prerelease session with information about stress reactions, ways of dealing with them, and where to get help.
- Have person face away from incident, or put person on other side of a vehicle.
- If smells are prominent, person should be moved up wind.
- If patient should not be moved, place an object to block patient's view.
- When engaged in on-scene psychological first aid, peers can ask "Hey, are you OK?"
- For psychological first aid, sometime it is just lending a sympathetic ear.
- If you need to prompt a person to start talking, start asking about facts first, and only after some rapport is established, start asking about feelings.
- Ensure to validate person's feelings, "Hey, this is pretty hard for **all** of us to take." then back off, going to another person or another topic; do not abandon the person, but monitor him or her; arrange extra help if it seems necessary.

5.4.5 Critical Incident Stress Debriefing (CISD)

OBJECTIVE: Describe CISD and how it works to all SAR members.

CISD is designed to help people deal with their trauma, one incident at a time, by allowing them to talk about the incident when it happens without judgment or criticism. Debrief is peer-driven and the people giving the treatment may come from all walks of life. All interventions are strictly confidential; the only caveat to this is if the person doing the intervention determines that the person being helped is a danger to themselves or to others. The emphasis is always on keeping people safe and returning them quickly to more normal levels of functioning.

Normal is different for everyone and it is not easy to quantify. Critical incidents raise stress levels dramatically in a short period of time and after treatment a new normal is established, however, it is always higher than the old level. The purpose of the intervention process is to establish or set the new normal stress levels as low as possible.

5.4.5.1 Types of intervention

The type of intervention used depends on the situation, the number of people involved, and their proximity to the event. The optimum is a three-step approach that addresses the trauma at various stages of progression: defusing, debriefing, and individual follow-up.

Defusing - is the term given to the method of *talking it out* (taking the fuse out of an emotional bomb). It allows team members the opportunity to ventilate about their incident related memories, stresses, losses, and methods of coping, and be able to do so in a safe and supportive environment. It is important to note that the CISD leader allow individuals the opportunity to tell what ***they*** saw, heard or felt. There is no cross talk. Each searcher has an opportunity to say what they need to without being interrupted, judged or corrected. Once they hear the other searcher's stories, then individuals tend to feel normalized. The defusing process usually involves informal and impromptu sessions. A defusing is done the day of the incident before the person(s) has a chance to sleep. Defusing is designed to assure the person/people involved that their feelings are normal, tells them what symptoms to watch for over the short term and to offer them a lifeline in the form of a telephone number where they can reach someone who they can talk to. Defusing's are limited only to individuals directly involved in the incident and are often done informally, sometimes at the scene.

Because the allotted time is often too brief, the defusing session is simply a starting point. Further intervention is often required and this can be anything from offering ongoing support (i.e. briefly touching base with the person/team in the coming days/weeks) to scheduling and providing formal debriefing sessions.

Debriefing - debriefings are usually the second level of intervention for those directly affected by the incident and often the first for those not directly involved.

A debriefing is normally done within 72 hours of the incident and gives the individual or team the opportunity to talk about their experience, how it has affected them, brainstorm coping mechanisms, identify individuals at risk, and inform the individual or team about services available to them in their community. The final step is to follow up with them the day after the debriefing to ensure that they are safe and coping well or to refer the individual for professional counseling.

The debriefing process (defined by the International Critical Incident Stress Foundation [ICISF]) has seven steps:

- Introduction of intervener and participants, establishment of guidelines.
- Details of the event given from individual perspectives.
- Emotional responses given subjectively.
- Personal reaction and actions.
- Followed again by a discussion of symptoms exhibited since the event.
- Instruction phase where the team discusses the symptoms and assures. Participants that any symptoms are a normal reaction to an abnormal event and generally these symptoms will diminish with time and self-care.
- During the shared informal discussion the intervener is always watching for individuals who are not coping well and additional assistance is offered at the conclusion of the debrief.

Follow-up - the important final step is follow-up. This is generally done within the week following the debriefing by team members as a check-in.

Psychological First Aid (PFA): In 2006 the American Red Cross began offering its own Psychological First Aid: Helping Others in Times of Stress. The twelve principles of its PFA program are:

- Making a connection.
- Helping people be safe.
- Being kind, calm, and compassionate.
- Meeting people's basic needs.
- Listening.
- Giving realistic assurance.
- Encouraging good coping.
- Helping people connect.
- Giving accurate and timely information.
- Making a referral to a Disaster Mental Health worker.
- Ending the conversation.
- Taking care of yourself.

These principles allow all responders to focus their *awareness, attitudes, and actions* to support survivors and helpers.

5.5 Professionalism / Code of Ethics / Conduct

Professionalism and a Code of Ethics/Conduct is established and agreed upon by each member to maintain and protect the credibility of the volunteer organization.

Each searcher is part of a team that involves any number of people as well as other organizations. The searcher and his/her team are summoned to every search to assist in locating the missing or lost person(s). The expectation is that searchers are trained to be professional and use a Code of Ethics/Conduct.

5.5.1 Professionalism

Professionalism is how you dress, speak, perform and behave at all search activities. Professionalism is about being part of a team that preserves the safety for all, recognizes individual abilities to do any tasks assigned, is aware of individual strengths and weaknesses and that each member is able to communicate that information.

A Professional Searcher continuously seeks opportunities for continued learning regarding knowledge, skills and abilities by:

- Maintaining a constant state of readiness.
- Joining committees and other like organizations.
- Reading and keeping informed of the latest and greatest.
- Attending training, exercises and drills, therefore seeking to improve self, as well as learn from their mistakes.

5.5.2 Codes of Ethics / Conduct

The public and other organizations have expectations of SAR teams and individual searchers. If a SAR logo or uniform is worn, a searcher is expected to be prepared, skilled and knowledgeable. Credibility for SAR teams is paramount, including how you treat others both within the team and outside the team.

The search environment, as well as the training and learning environment must be free from harassment, ridicule, discrimination to race, sex, age and culture. The searcher speaks and allows others to speak their opinion, using open honest face to face communication. The searcher must use appropriate language. On a search it is expected that every searcher is:

- Organized, ready and able to search at an expected level.
- Co-operative and uses self-discipline.
- Able to give and take advice.
- Self-sufficient.
- Dressed properly with required equipment.
- Knows the structure of a team and the responsibilities of each role.

What could go wrong?
When a group, a team within that group, or an individual searcher does not portray themselves in a professional manner it reflects on the whole SAR volunteer organization. Credibility is difficult to achieve but easy to lose.

5.6 Focus on Task at Hand

A searcher is expected to arrive at a search prepared to focus on the search and in particular the task assigned to the team the searcher is on.

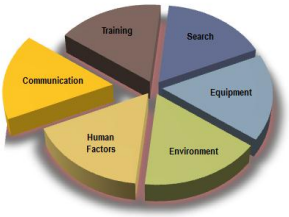
When the team leaves the command post, the team leader and all members of that team are to focus on the team assignment. Smoking, eating, talking about subjects other than the task, must be ultimately controlled by the team leader. When a searcher

feels he/she needs a break in order to re-focus, that person informs the team leader and a break is requested.

At any time while on task, if an individual is unable to focus due to fatigue or for any other reason, that individual must then inform the team leader and request to return to the command post.

Command post expects that all individuals have arrived to the search ready and able to perform their tasks, in order that the search can be carried out in a professional and proficient manner.

6 Communication



OBJECTIVE: Provide awareness to how vital communication is to a SAR organization. Describe all types of communications utilized by SAR personnel.

6.1 Radio

What is the most important piece of gear for a SAR team in the field? Most would answer *the radio*. It is a vital link to command post, permitting communication of located clues, progress of task assigned, change in strategy and possible location of subject. It is also a tool that will enable different teams to communicate with each other via a common frequency.

SAR team members are expected to understand the non-technical information in this section on radio communication. It is important to understand how your radio works and what to do when it does not work. Some of the common concerns are; weak or dead battery, unclear transmissions, too much chatter and unable to contact command post or command post unable to contact the team.

Types of radios used are:

- Command post radio, which is in a fixed location and has more power than the hand-held radios utilized by teams in the field.
- Mobile unit transceiver, which could be in a vehicle, again this radio is more powerful than the hand-held radios utilized by teams in the field.
- Portable or hand held transceiver radios.

Terms necessary for understanding hand held radio:

- *Transceiver* - this is a radio that consists of two parts, one that emits a signal and one that receives the signal.
- *On/Off/Volume* - one knob for both functions, to be turned clockwise for *ON* and volume.
- *Squelch* - the squelch setting affects the receiver sensitivity of the radio; turn the knob until you hear the squelch and then back off slowly until noise is gone.

NOTE

Some radios have automatic squelch settings

- *Push To Talk (PTT) button* - PTT button when pushed activates transmitter and when released receiver is activated. Listen first, then push and hold, wait briefly prior to speaking in order to make sure all of your transmission is heard.
- *Doubling* – when two transmissions occur at the same time. This results in a garbled transmission or no transmission.
- *Transmit* – voice message sent from one radio and heard by another receiver radio.
- *Antenna* - on a hand held radio antenna is short, flexible and covered in PVC plastic. A telescopic or collapsing antenna is more effective but breaks in the field.
- *Radio signals* - generally travel in line of sight between transmitter and receiver. Communications can be blocked by objects in its path. Sometimes communication can be improved if you go to higher ground to restore line of sight.
- Two-way radios are *NOT* like telephones. Telephones are *full-duplex,* which means you can talk and listen at the same time. Most two-way radios are *simplex*, which means you cannot hear anyone when you have the PTT button depressed. Therefore it is important to listen before you begin your transmission.

6.1.1 Voice Procedures

Speak slowly and use clear simple accurate voice procedures to be able to communicate in a manner that is understood. Keep transmissions brief and relevant, with no excess chatter. Do not use profanity. When necessary use 24 hour time as well as the phonetic alphabet.

	Word	Pronunciation		Word	Pronunciation
A	ALPHA	AL FAH	**N**	NOVEMBER	NO VEM BER
B	BRAVO	BRAH VOH	**O**	OSCAR	OSS CAH
C	CHARLIE	CHAR LEE	**P**	PAPA	PAH PAH
D	DELTA	DELL TAH	**Q**	QUEBEC	KEH BECK
E	ECHO	ECK OH	**R**	ROMEO	ROW ME OH
F	FOXTROT	FOKS TROT	**S**	SIERRA	SEE AIR RAH
G	GOLF	GOLF	**T**	TANGO	TANG GO
H	HOTEL	HO TELL	**U**	UNIFORM	YOU NEE FORM
I	INDIA	IN DEE AH	**V**	VICTOR	VIK TAH
J	JULIETTE	JEW LEE ETT	**W**	WHISKEY	WISS KEY
K	KILO	KEY LOH	**X**	X-RAY	ECKS RAY
L	LIMA	LEE MAH	**Y**	YANKEE	YANG KEY
M	MIKE	MIKE	**Z**	ZUZU	ZOO LOO
NOTE Underlined syllables carry the accent.					

Table 6-1 Phonetic Alphabet

Just as in normal conversations, when someone has difficulty understanding an unfamiliar word or name, the best way to get it across is to spell it. Therefore the only difference over a two-way radio system is these words are spelt phonetically to avoid confusion.

Example: ETA should be spoken as - Echo Tango Alpha.

Since many letters sound the same, phonetic alphabets have been developed to allow communicators to spell without confusion. The phonetic alphabet used by amateur radio operators (Hams) is the same as used by the military services, aviation facilities and mariners worldwide.

	Word	**Pronunciation**
0	ZERO	ZE RO
1	ONE	WUN
2	TWO	TOO
3	THREE	THU REE
4	FOUR	FOW ER
5	FIVE	FIFE
6	SIX	SIX
7	SEVEN	SEV EN
8	EIGHT	AIT
9	NINE	NIN ER
NOTE Underlined syllables carry the accent.		

Table 6-2 Numbers

Numbers should be transmitted digit by digit except that exact multiples of thousands may be spoken as such:

Numeral	Spoken As
44	FOW-ER FOW-ER
90	NIN-ER ZE-RO
7000	SEV-EN THOUSAND
5318	FIFE THU-REE WUN AIT

Table 6-3 Numbers Example

The decimal point is to be spoken as *DAY-CE-MAL*.
Example - 987.6 is to be spoken as NIN-ER AIT SEV-EN DAY-SEE-MAL SIX.

Dates will be spoken digit by digit, with the months in full.
Example - 20 August is spoken as TOO ZE-RO AUGUST".

Grid references will be spoken digit by digit, preceded by the proword *GRID*. The word *TACK* or *DASH* is spoken between the two groups of figures.
Example - Grid 3018-4576 is spoken as GRID THU-REE ZE-RO WUN AIT TACK FOW-ER FIFE SEV-EN SIX.

6.1.2 Prowords

Prowords are pronounceable words or phrases which have been assigned meanings for the purpose of expediting message handling on circuits where radio communication procedure is employed. In no case shall a proword or a combination of prowords be substituted for the textual component of a message.

Proword	Description
ACKNOWLEDGE	An instruction to the addressee that the message must be acknowledged.
AFFIRMATIVE	Yes
ALL AFTER	The portion of the message to which I have reference is all that which follows _____.
ALL BEFORE	The portion of the message to which I have reference is all that which precedes _____.
ANSWER AFTER	The station called is to answer after call sign _____ when answering transmissions.
BREAK	I hereby indicate the separation of the text from other portions of the message
BREAK BREAK BREAK	Used to interrupt an ongoing conversation when you have an urgent transmission only.
CALL SIGN	The group that follows is a call sign.
CORRECT	You are correct, or what you have transmitted is correct.
CORRECTION	An error has been made in this transmission. Transmission will continue with the last word correctly transmitted_____.
DISREGARD THIS TRANSMISSION - OUT	This transmission is in error. Disregard it. (This proword shall not be used to cancel any message that has been completely transmitted and for which receipt or acknowledgment has been received.)
FIGURES	Numerals or numbers follow.
FROM	The originator of this message is indicated by the address designator immediately following.
GRID	The portion following is a grid reference.
I READ BACK	The following is my response to your instructions to read back.
I SAY AGAIN	I am repeating transmission or portion indicated.
I SPELL	I shall spell the next word phonetically.
I VERIFY	That which follows has been verified at your request and is repeated. (To be used only as a reply to VERIFY.)
MESSAGE	A message which requires recording is about to follow. (Transmitted immediately after the call).
NEGATIVE	No
NO DUFF	The message that follows is NOT an exercise message. Used to indicate an *actual emergency* during an exercise.

NOTHING HEARD	To be used when no reply is received from a called station.
OUT	This is the end of my transmission to you and no answer is required or expected.
OVER	This is the end of my transmission to you and a response is necessary. Go ahead, transmit.
READ BACK	Repeat this entire transmission back to me exactly as received.
RELAY (TO)	Transmit this message to all addressees (or addressees immediately following this proword).
RELAY THROUGH	Relay your message through call sign _____
ROGER	I have received your last transmission satisfactorily. Note that it does not mean *Yes.*
SAY AGAIN	Repeat all of your last transmission. Followed by identification data means Repeat_____ (portion indicated).
SILENCE (repeated three or more times)	Cease transmissions on this net immediately. Silence will be maintained until lifted.
SILENCE LIFTED	Silence is lifted.
SPEAK SLOWER	Your transmission is too fast. Reduce speed of transmission.
THIS IS	This transmission is from the station whose designator immediately follows.
THROUGH ME	Relay your message through me.
TIME	That which immediately follows is the time or date-time group of the message.
TO	The addressees immediately following are addressed for action.
UNKNOWN STATION	The identity of the station with whom I am attempting to establish communication is unknown.
VERIFY	Verify entire message (or portion indicated) with the originator and send correct version. (To be used only at the discretion of, or by, the addressee to which the questioned message was directed.)
WAIT	I must pause for a few seconds.
WAIT - OUT	I must pause longer than a few seconds.
WILCO	I have received your signal, understand it, and will comply. To be used only by the addressee. Since the meaning of ROGER is included in that of WILCO, the two prowords are never used together.
WORD AFTER	The word of the message to which I have reference is that which follows_____.
WORD BEFORE	The word of the message to which I have reference is that which precedes _____.

Table 6-4 Radio Prowords

6.1.3 Urgency Signals

Although it is unlikely that urgency signals will be heard on GSAR nets, the possibility does exist. It is therefore important that GSAR communication members be familiar with the following 3 urgency signals that may be encountered.

- *MAYDAY* - this signal, referred to as the *International Distress Signal*, indicates that a station is threatened by grave and imminent danger to life and property, and requires immediate assistance. The word *MAYDAY* will be transmitted 3 times. After the distress signal is sent *all traffic* will cease and all stations will monitor. Any station in a position to render assistance will do so and all other stations will continue to monitor until the situation is rectified and the frequency is released for normal use.

- *PAN PAN* - this signal, referred to as the *International Urgency Signal*, indicates the calling station has a very urgent message concerning the safety of a person or persons, aircraft, ship or other vehicles. The words *PAN PAN* are transmitted 3 times. All traffic will cease. All stations will continue to monitor until the situation is rectified and the frequency is released for normal usage.

- *SECURITE* - this signal, referred to as the *International Safety Signal*, indicates that a station is going to transmit a message concerning the safety of navigation or send important meteorological warnings that will, or can, affect a person or persons, aircraft, ships or other vehicles. The word *SECURITE* (pronounced *SEE CURI TAY*) will be sent 3 times. All traffic will cease. All stations will monitor until the frequency is clear.

6.1.4 Radio Protocols

- A standard practice when contacting command post is “Command post – this is team 1”. Listen before you talk, press PTT button, wait for the count of 2 prior to speaking. Release the PTT button after speaking.
- When using numbers, use single digits,
  Example: 75 would be transmitted as “*figures seven, five”* and 100 would be “*figures one zero zero*”.
- Use 24 hour time.
- A radio check is required prior to leaving base. Some descriptions of how you are transmitting are:
  - Loud and clear
  - Weak but clear
  - Breaking up
  - Unreadable

  Example: “Command post - this is team 1 for radio check over”.
  “Team 1 - this is command post you are loud and clear over”.

- Codes should be kept to a minimum and these codes should be as simple as possible. Codes often are complicated and allow for mistakes. One code that is necessary is a *death code* or *condition code*. Family or media may be within hearing distance of the radio therefore a *death code* or *condition code* must be agreed upon within each SAR unit. An example is *code black* or *code grey*.

6.1.5 Troubleshooting Loss of Signal

- Repeat communication.
- Check channel and battery.
- Change location/orientation/use higher ground.
- Return to last location with good communication.
- Use alternate radio if possible.

Points to remember:

- *Listen* before making a call.
- Speak *slowly* and *clearly*.
- Make your calls *brief,* others may want to use the same channel.
- *Always* start with *call-signs*, theirs and yours.
- *Always* finish a transmission with either *Over* or *Out* (never both). This tells the other station that you have finished speaking and it's their turn.
- *Never* interrupt another conversation. Wait until the air is clear.

6.1.6 Best Practices

- All radios charged and ready for every search.
- Radios are signed out and signed back in.
- Settings are understood - on/off/volume, channel, squelch.
- Understand range of use and limitations of radio.
- Protect radio from the elements by using a speaker microphone.
- Optimize location and/or position to transmit and receive.
- Remain calm and speak clearly.
- Check-in periodically after initial radio check.
- Turn radio off or lower volume when returning to command post.
- Be aware that family and/or media could be at command post when you are transmitting your message (watch what and how you say things).

6.2 Team Communication

OBJECTIVE: Team communications comes in many different forms. In this section we will provide information on how these communications relate to SAR functions.

6.2.1 Call-out

The call-out procedure is initiated by the SAR manager or person in charge of the search. This procedure varies between different SAR teams. Many use pagers or a telephone fan-out system to alert members that they are required for a search.

There are two different types of call-out. The *activation* call-out which is for members to mobilize immediately or at a prescribed time and place. The *stand-by* call-out is for members to prepare for a possible search and to await further information and contact.

Members use a call-back system to inform that they are able to attend or not and for approximately how long. This information is important when putting teams together and assigning tasks.

Once a member has been activated or is on stand-by, that member has to prepare for the search (i.e. gas in vehicle, personal gear, food, weather, inform family and employer).

The following is the information necessary to activate the call-out:

- Description of situation (who, what, when, where, how).
- When and where to report.
- Rendezvous location.
- Personal equipment needed.
- Weather and terrain expected.
- How to access updated information/or call-off if subject is found.
- If possible, approximate time needed for the search.

6.2.2 Sign-in / Sign-out

Once at the rendezvous location or at the site of the search, all searchers must sign-in and be accounted for. Teams will be formed and tasks will be assigned. This is time for searchers to make sure they are ready with personal equipment, are aware of and writing down details of the search and are ready to start. Know what to expect and be prepared. This is typically the *hurry-up-and-wait* time. When it is time to demobilize all searchers and equipment needs to be accounted for.

The searcher must always sign-out and inform those necessary when they are leaving. It is also important at this time to assist with the post search work. The searcher should ask what he/she can do and learn this process. Everyone wants to go home and this time will go faster if everyone helps.

6.2.3 Briefing

Everyone must be briefed. Know the subject description, possible clues and what the individual searcher's assignment will be. The team leader needs to know the following information (he/she will be briefed by command post) and pass it on to his/her team:

- Situation, objectives, strategies and predictions.
- Subject information:
    - Experience in the bush
    - Physical description
    - Clothing and equipment
    - Physical condition
    - Mental condition
    - Behavioral traits
    - Circumstances leading up to the search
- Vital concerns – medical/health and any medication.
- Clue considerations – footwear (footprint) and items carried by subject

NOTE

The team leader should know how to report clues, log location of clue, mark and protect clue for follow-up.

- Subject's trip plan.
- Terrain, hazards and danger zones in the area.
- Current and predicted weather.
- Equipment searchers will need.
- Communication details - frequency, channel, phone numbers etc.
- Transportation details.
- How long team will be out in the field.
- Who the relatives and/or close friends are and where they are located if in the area.
- Media procedures – instructions to searchers if approached by media.
- What the task or assignment is for that team-area where to start and how to get there.
    - Type of task (search pattern to be used).
    - Expected Probability of Detection (POD).
    - Flagging and marking procedures.
    - What teams are adjacent or near.
    - If area has been searched before.
    - When to start and when to stop.
    - What to do if subject found - alive, injured, dead and instructions for protecting scene.

Team leaders need to know exactly what is to be done. They need to pass on and emphasize any medical plan, as well as a rescue and evacuation plan. Team leaders need to know if any codes will be used.

6.2.4 Debriefing

This is a tool for evaluating every search and search exercise as well as giving information for future searches and exercises.

This is the time for sharing information about the search by searchers, team leaders and search managers. Search manager will debrief with team leaders, team leaders debrief with searchers and the search manager debriefs with all team leaders and searchers together when needed.

Some information that should be covered:

- What area was covered?
- Determine POD.
- Reveal all clues and their location.
- Any concerns, difficulties or gaps in areas covered.
- Hazards encountered.
- Communication concerns.
- Ideas, observations or recommendations for future searches or exercises.

6.3 Initial Basic In-field Interviewing Techniques

The purpose of interviewing is to gain and/or confirm additional information as to the likelihood of the missing or lost person(s) being or has been in the area and utilized to narrow down or expand the search area based on the information gained from the interviewee.

NOTE

Be a good listener and take notes. Do not ask leading questions

How to conduct the interview - document the time/location/name and contact information on the person(s) being interviewed. Include a description of those being interviewed and what was said.

Approach to be used when conducting an interview:

- When you meet interviewee(s), hold the search line, mark the forward position and conduct the interview in the area already searched.
- Approach the contact(s) in a friendly manner, make them feel at ease and build a rapport with him/her.
- Explain the reason for the interview and explain that you will be taking notes.
- Ask - *Have you seen anyone in the area?*

- If so - have them describe the individual(s) along with their recollection about the person(s) and anything they witnessed.
- Ask - *Where, time, direction of travel?*
- Ask - *Did you notice anything unusual in the area?*
- Ask - *How did the person appear to you?*
- Ask additional questions depending on response such as (the person looked really confused) then ask for them to explain what their perception was.
- If the information the interviewee(s) has provided fits the description of the missing or lost person(s), you may show the interviewee a picture of the subject to see if this is actually the person they saw.
- Remind the interviewee(s) this is an active search area. Encourage the interviewee to carry on, but to please stay on the trail and leave the area.
- Remind the interviewee that should they happen upon something out of the ordinary or another subject or the subject, to report it immediately to a searcher or the command post. Explain where the command post is in reference to their present location.

NOTE

If the person does not want to or refuses to talk, document the description of the person(s) time, location, direction of travel and report this to the command post.

6.4 Media

OBJECTIVES: Provide guidance to searchers in dealing with the media.

When a searcher is approached by the media, the searcher should direct the media to the appropriate authority (command post). Under no circumstances should the searcher answer any questions the media shall have. Do not offer any personal opinions.

6.5 Social Media / Cell Phones / Cameras

Misuse of social media/cell phones/cameras can adversely affect the credibility of the search team, how it's perceived by the community and police services and its relationship with both. This could potentially lead towards possible lawsuits and not being utilized.

6.5.1 Social Media

Social media can include Facebook, Twitter, MSN, E-mail and YouTube, but not just limited to these specific sites. Things you need to remember as a searcher:

- Confidentiality – refraining from engaging in any form of social media before commencing, during search and post search.
- Use of actual information and descriptions of the scene are a breach of confidentiality.
- Code of conduct – signed by members – will not divulge any information on the missing or lost person(s).
- Do not attempt to contact any missing or lost person(s) or related member either by cell phone, texting or any social media.
- Searchers are not permitted to divulge sensitive material at any time to unauthorized person(s).

6.5.2 Cell Phones

- Members are discouraged from using cell phones unless it's an emergency situation, not related to the search or as an expressed function of the search team (communication with radios are not functioning).
- The use of your personal equipment during a search may become part of the evidence.

6.5.3 Cameras

Waiver – only authorized person(s) take pictures with the knowledge that the camera may be turned over to the authority that has jurisdiction for further review.

NOTE

Volunteers should adhere to their team's policy regarding the use of information and technology.

7 Training

This chapter will discuss many elements and required training that a basic searcher will require to be a proficient SAR team member.

7.1 Probability of Detection (POD) – Probability of Area (POA)

POD is defined as the likelihood of your search team finding a clue/subject in a defined search area and is given as a mathematical percentage, based on experience. Many factors are involved in increasing or decreasing the POD (i.e. terrain, vegetation, visibility, weather, distractions, equipment, search pattern, critical distance and search skills).

Gut Feel	POD %
Bet my life	100%
I'm positive	90%
I'm sure	80%
I'm convinced	70%
A good chance	60%
It's 50 / 50	50%
I think so	40%
Could be	30%
Maybe	20%
Perhaps	10%
NO way	0 %

Table 7-1 POD %

POA is defined as an estimate of the probability that the subject is within a specific area. The total of the POA's of all areas being considered for searching must equal 100%. In order to cover all possibilities, a search segment known as *Rest of the World* (ROW) is also declared. This makes allowance for the situation where he or she might not be in the areas being considered (home, with friends or out of the historically-indicated search range, etc.) The POA of an area is estimated by the command post, and an area's POA can change as a result of POD's reported by returning search teams.

7.2 Point Last Seen (PLS) – Last Known Position (LKP)

PLS is the last spot anyone actually saw the missing or lost person(s). PLS is established by witnesses.

LKP is the last spot at which we can definitely establish the person(s) presence. Some examples are:

- Telephone call from the missing or lost person(s) to his/her family.
- Trail log at the start of a wilderness trail.
- The person(s) parked car.
- An article of the missing lost person's clothing discarded along the trail.
- A gasoline credit card receipt.
- Interviews conducted with family/friends.

These points may be the same or different, and they may change during the search. At the start, PLS and LKP may be the same and are established by the individual reporting the missing lost person(s) overdue. As the search continues, a new LKP may be established by finding the person's car at a trailhead. Good news media coverage may bring in witness reports that move the PLS. Constant efforts to develop more information refine the PLS and LKP to reduce the search area.

Protecting the LKP and PLS

Once you have the LKP and PLS, it is important to protect each. These are the starting points for intensive field efforts and may be rich with clues for a successful search. This means:

- *Approach with caution and on foot* - the ground may have footprints that can be identified and used to track the person. Even a parked car on a roadside should be approached carefully to avoid trampling evidence. One searcher is enough.
- *Keep the number on scene down* - more people means more footprints for trackers to deal with and more scents to confuse search dogs.
- *Don't handle things* - discarded clothing and food wrappers can be visually identified. Leave them where they lie for trackers and dog teams. It is very useful to have a supply of inexpensive surveyor's flags (a plastic flag on a short metal stake) or flagging tape that can be used to mark such clues.
- *Keep purposeless activity to a minimum* - it is hard to restrain the enthusiasm of searchers wanting to immediately charge into the brush. Until the scene has been checked, you have no idea in which direction the person went. Charging off can destroy valuable clues, create misleading signs for tracking teams and waste everyone's time.

7.3 Knots

OBJECTIVE: There are many different kinds of knots with a variety of uses. The following are the suggested knots, bends and hitches that a basic searcher should know. Knowing how to tie knots/hitches in the SAR environment is for the purpose of securing equipment and during rescue operations.

The best knots are those which tie easily, hold fast, accomplish their purpose and untie with ease. Basic terminology for ropes and knots:

- *Running end* - end of the rope which is manipulated the most while tying a knot.
- *Standing part* - the main part of the rope.
- *Bight* - made by bending the free end over the standing part until the two are parallel.
- *Loop* - when a rope circles around and then crosses over or under itself,
- *Turn* - loop the rope once around the object
- *Round turn* - loop the rope twice around the object
- *Whipping* - twine wrapped and secured to the end of a rope to prevent the end from fraying.

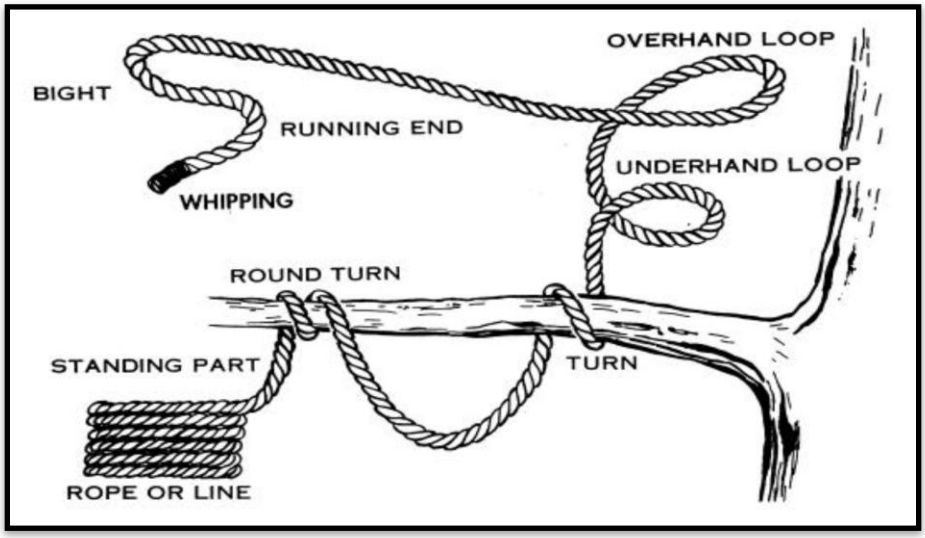


Figure 7-1 Rope / Knot Terminology

After you tie a knot, it is important to *dress* the knot properly. This involves making sure that all parts of the knot are in the right place and that the rope doesn't cross over itself unnecessarily. Not dressing the knot can add additional stress to the rope fibers, weakening them.

Overhand Knot - pull the free end through the loop. It can be hard to untie once dressed. One purpose for this knot would be to keep your hand or object from running beyond the required point.

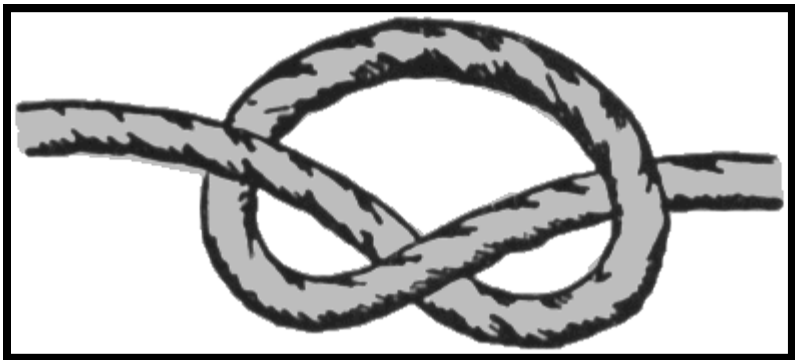


Figure 7-2 Overhand Knot

Figure Eight Knot - good stopper knot as it is easy to tie and untie. Used at the end of the rope to help prevent the end from slipping through the knot. This knot is larger, stronger and easier to untie than the overhand knot. It does not harm your rope as much as the overhand knot does.

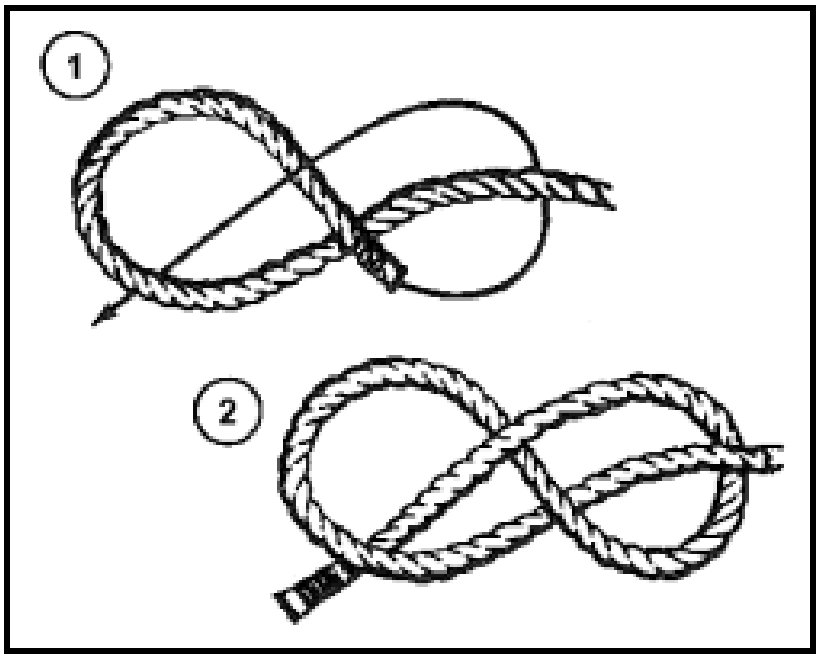


Figure 7-3 Figure Eight Knot

Reef Knot - used to tie two identical ropes together. Also used extensively in first aid when tying bandages or slings as this knot lies flat. Remembered by the verse; left over right, right over left.

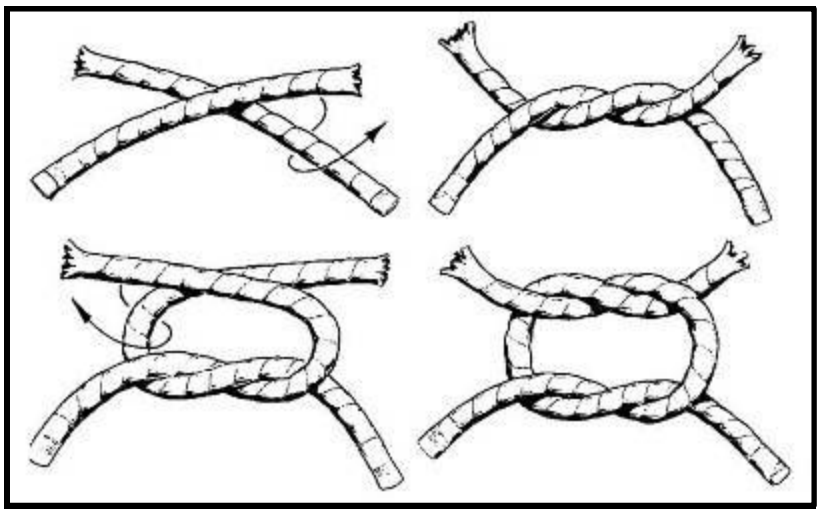


Figure 7-4 Reef Knot

Bowline - this knot will not slip or jam. This knot is made using only end of the rope. Form a small *eye* with the standing part running underneath. Pass the running end up through the *eye* making a large loop to surround the item. Pass the running end around the standing end and back down through the *eye* and hold in place. Pull the standing end to tighten.

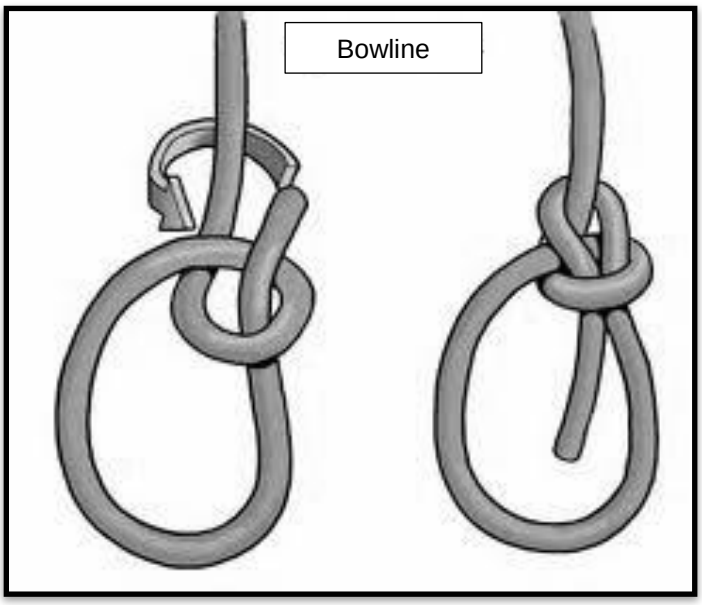


Figure 7-5 Bowline

Clove Hitch – can be used for lashing (holding two or more poles together). All lashing begin and end with clove hitch. It can also be used to tie a lie to a tree or post. Loop the rope around a tree/pole with the running end lying over the standing part. Loop the rope around the tree/pole a second time. Pass the running end through this new loop and tighten it.

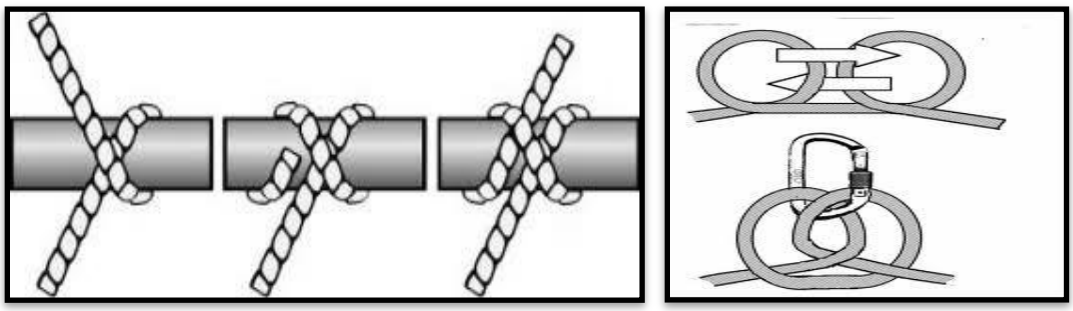


Figure 7-6 Clove Hitch

Alternatively, holding one end in the left hand, form an underhand loop, then an overhand loop right next to it. Place the second loop on top of the first loop and drop them both over the post and pull tight.

Half Hitches – are great for tying down tarps. If used in conjunction with a round turn, it will put a tight grip on the tree.

- Pass the running end of the rope through a grommet or around a tree to from a bight (or loop around more times for a tighter grip).
- Loop the running end over the standing part and pull it up between the tree and the beginning loop.
- Repeat these 2 steps, tying the hitch away from the grommet.
- Pull on both the running end and the standing part of the rope to tighten the knot.

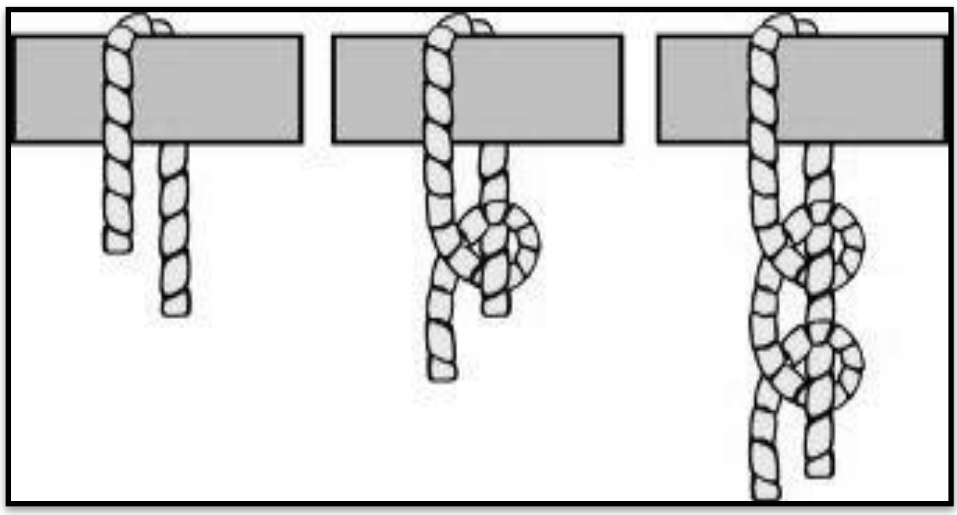


Figure 7-7 Half Hitches

Quick Release -Two Half Hitches - this knot holds well under strain and comes loose easily with a pull on the running end.

- Follow steps 1 to 4 (Half Hitches) and make 2 Half Hitches.
- Make a quick release loop (slip knot), by making a loop for the 2nd hitch and not pulling it completely through.

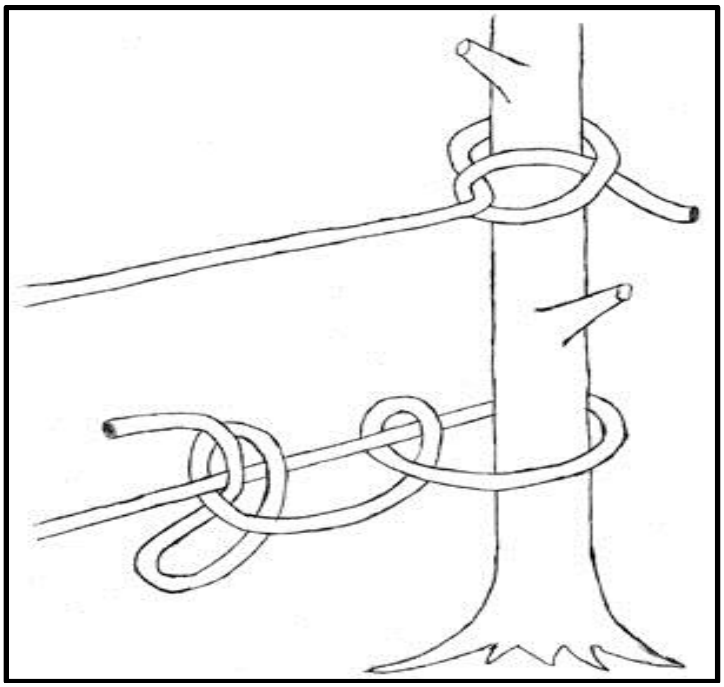


Figure 7-8 Quick Release - Two Half Hitches

Sheet Bend - used to join two ropes of unequal or equal sizes.

- Make a bight in the thicker of the two ropes.
- Pass the running end of the thinner rope through the middle of the bight.
- Wrap the running end around the back of the bight.
- Pass the running end under its own standing part and tighten it.

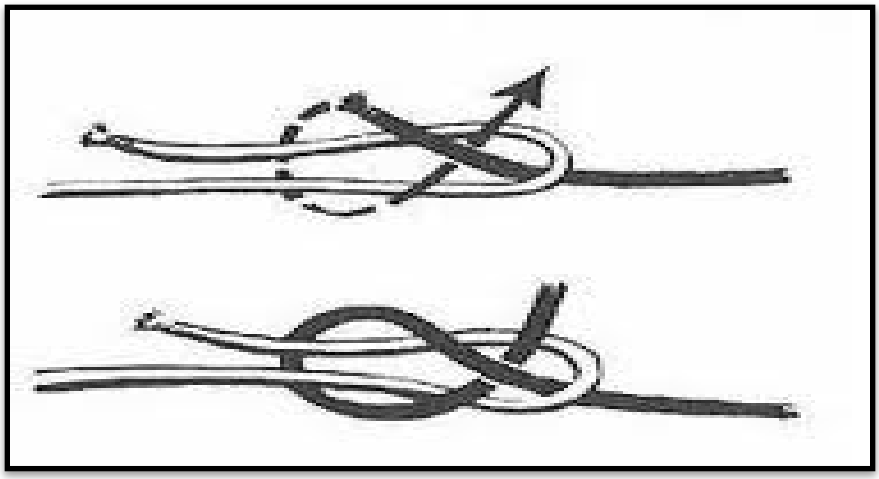


Figure 7-9 Sheet Bend

Fisherman's Knot – used to join two ropes which may or may not be of the same diameter or joining two ends of accessory cord to form a runner. It is sometimes used as an ending or safety knot.

- Overlap the two ends.
- Wrap one end around both ropes two full turns.
- Then pass this end back through these turns and pull tight.
- Next pass the other end two full turns around both ropes.
- Pass this end back through and pull tight.
- Pull on both ropes to tighten the two knots against each other.

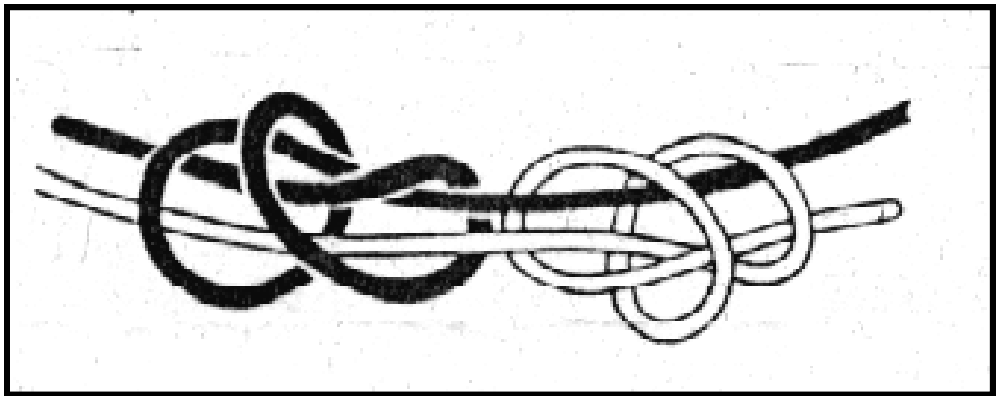


Figure 7-10 Fisherman's Knot

Prusik - the primary hitch in rope rescue work. Used in tandem with another prusik, climbing up a stationary rope is possible.
Tie the ends of a small diameter rope with a double fisherman's knot.
Wrap the loops around the stationary rope three times from outside to inside and tighten.

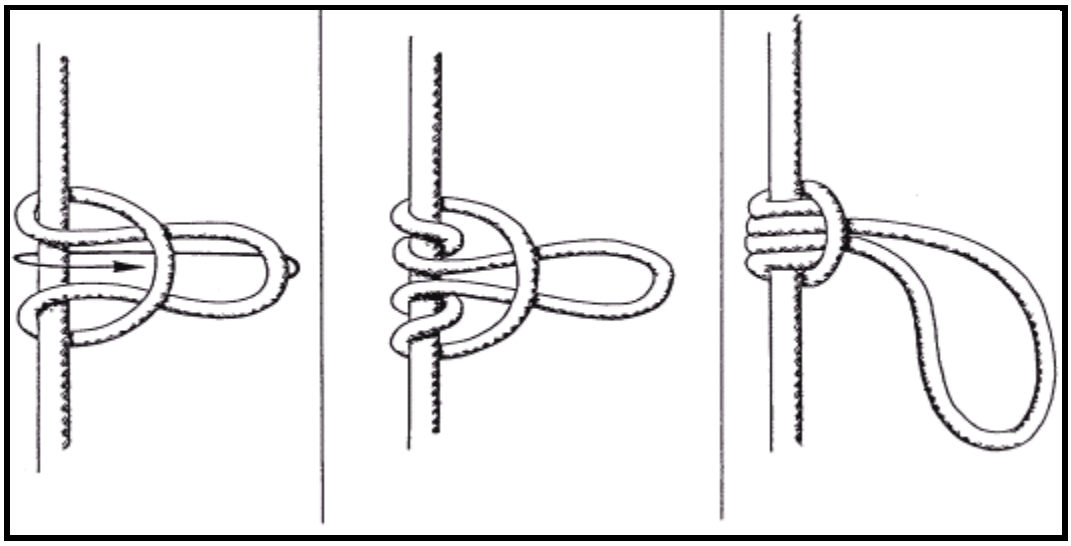


Figure 7-11 Prusik

Sheepshank - used to shorten a rope and strengthens it where the additional rope is held.
This is a temporary knot as it will only hold as long as there is a strain on it.

- Gather into a double bight any extra rope.
- Secure the three strands with a half hitch tied at each end of the double bight.

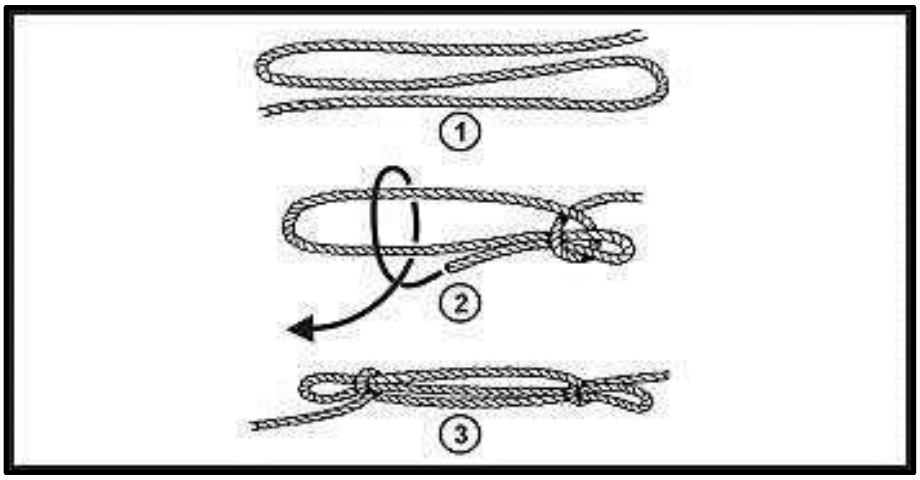


Figure 7-12 Sheepshank

Whipping - twine is wrapped and secured to the end of a rope to prevent the end from fraying. Starting from either end, form a bight and start wrapping the twine tightly around the rope end working to the exposed loop. Slip the twine end through the loop and pull on the standing twine pulling the working twine into the whipping. Cut off any remaining twine.

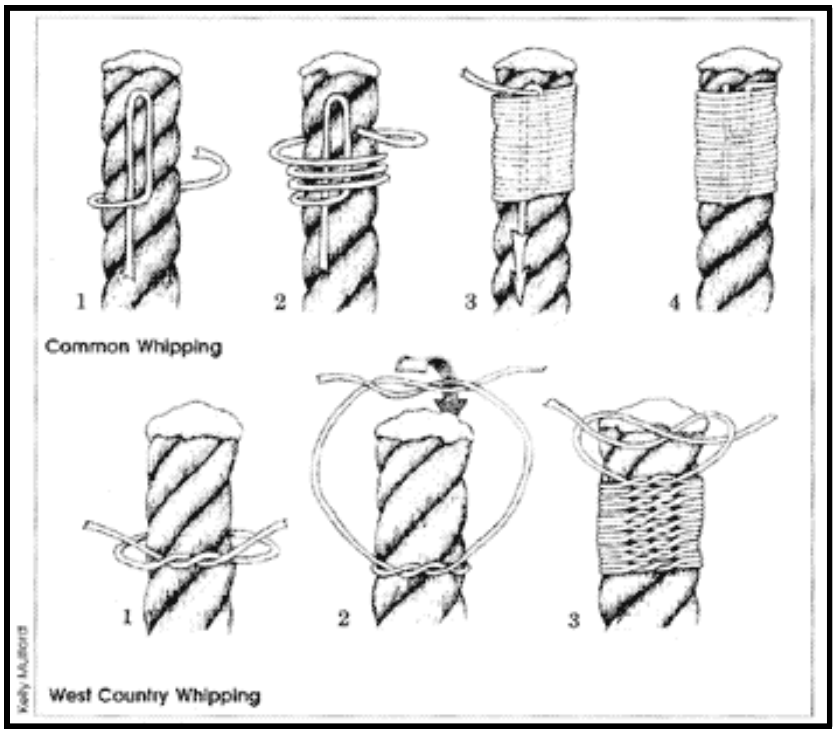


Figure 7-13 Whipping

Lashing - used for lashing poles together (emergency shelters, stretchers). Each turn must be drawn tight and kept close to the rest without overlapping; neat and tight with the ends snug.

- Starting with a clove hitch, wrapping the rope tightly in a figure 8 pattern until strength has been achieved.
- Finish lashing with a clove hitch.

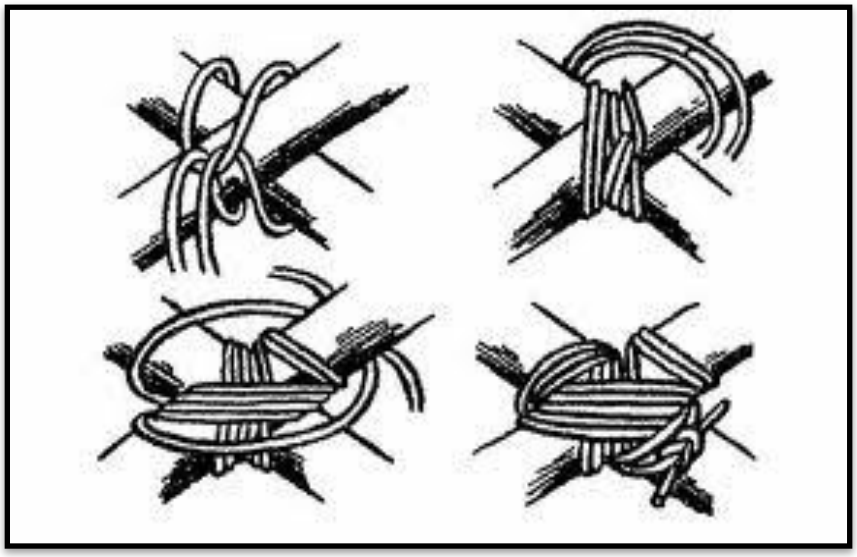


Figure 7-14 Lashing

Care of your rope:

- Protect your rope at potential abrasion points. Most ropes are retired because they have frayed. Retire your rope if you can see the core at an abraded area or if the rope feels lumpy.
- Keep your rope clean. Dirt can abrade your rope shortening its life span. Wash with soap and water, and air dry
- Occasionally using liquid fabric softener during the rinsing can make your rope more pliable.
- Hang your ropes to dry away from direct sun light.
- Protect your rope from chemical contact. Some compounds contain acids that break down the rope fibers.
- Never walk on a rope. That grinds in dirt causing excessive wear.
- Try not to run the rope over sharp edges.
- Whip the ends to keep it from fraying.
- Try not to leave the ropes knotted or under tension longer than necessary.
- Never use a climbing rope for any other purpose.
- Keep your rope coiled and ready for use.

Practical Exercise
Exercise 1
Equipment needed - 6 pieces of rope or heavy cord, cut into 1 m lengths.
Relay teams are comprised of an equal number of participants. Starting with the clove hitch, assign 5 other knots to be completed by each participant. Upon each participant completing the 6 knots, they undo them and the next member commences.

Exercise 2
This activity can be carried out as a day or overnight exercise. Using only rope/twine as the *tying* subject, create your lodging (improvised shelter) for the evening. Other rope activities can include hang a tarp for shelter, or tying up your pack away from animals. Select the correct knots and explain why you chose it.

7.4 Wilderness Survival

OBJECTIVE: In this section, wilderness survival techniques will be discussed from building improvised shelter, starting fires, and discussions on survival patterns and psychology of survival.

NOTE
In a survival situation you must be alert, keep calm, think clearly and act decisively.

Points to remember if you are going to venture off into the wilderness:

- Before leaving on any trip, write down your itinerary, including where you plan to go, and how long it is anticipated that you will be gone. Give this to someone before you leave home.
- Rapid weather changes are often responsible for survival situations. Check the weather forecast before you leave.
- Stay on the trails. Wandering off of established trails and bushwhacking in search of help will impede the rescuer's efforts to locate you.
- Be prepared to signal for help, or respond to searchers.

7.4.1 Group Survival

The best chance of survival belongs to the group that works well together. Having good leadership has its advantages. Leaders should:

- Know what your group is doing at all times.
- Maintain clear communications with your group at all times.
- Give clear instructions to your group and ensure that they are understood.
- Assign a specific task to each person incorporating their skills or talents. Ensure that they understand what you want them to do.
- Maintain control of your group.
- Maintain a good chain of command that includes all members. Each person should have an awareness of the roles of the other members and where they fit within that structure.
- As a leader, set the example. Group survival is a test of the leadership.

- Develop a feeling of mutual need. Each person's responsibility is to ensure that the group survives.
- Establish attainable objectives. This can be accumulative step-by-step goals.
- Adapt to changes, altering goals as needed.
- Patience is required by all, as situations change. Try to keep calm throughout.
- Hope for the *best*, but members should be prepared for the *worst*.

Controlling fear - work with your group, recognizing that fear is a natural phenomenon. Try to determine what is causing the fear and work to lesson or eliminate it. Practice discipline within the group. Use positive affirmation within the group to strengthen their resolve. Accept differences of opinions, though ultimately, after hearing the suggestions from the group, the leader will have to finalize the decision. Accept the limitations of members of the group, and encourage them to do all that they can for the benefit of the group.

7.4.2 Improvised Shelter

Next to water, shelter is the greatest necessity of life. You can die of exposure before succumbing to starvation. Anything that protects the body from the environment can be called a shelter. When confronted with inclement weather, adequate shelter can extend your survival time. A small shelter, insulated from the bottom, protected from the wind and snow, with a fire close by is the goal.

Natural shelters:

- Caves and overhanging cliffs. If you choose to use a cave as your shelter, build your fire near its mouth to prevent animals from entering. Carefully consider the direction of the wind when building the fire.
- Natural pit under a fallen tree - line it with bark or tree boughs.
- Rocky coastal area - build a rock shelter in the shape of a U, covering the roof with driftwood, tarp or seaweed.
- Lean-to - make with fallen trees and covered with boughs, thick grasses, bark or plastic (tarp).
- Wigwam - by using 3 *poles* tied together at the top. Cover the sides with boughs, tarps/plastic, rain gear, etc.
- Snow cave - burrow a tunnel into the snow - ensure to make 2 ventilation holes in the *roof*. Also ensure that you leave a clear marker to remain visible to searchers.

Figure 7-15 Lean-to Shelter

Figure 7-16 Snow Cave

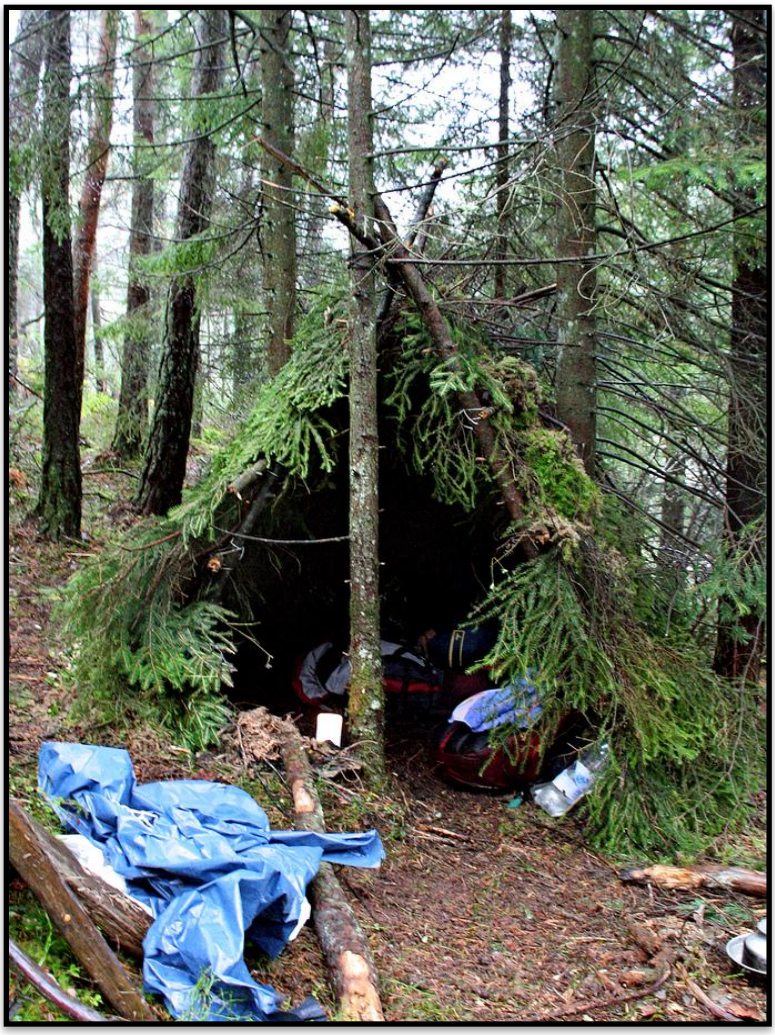


Figure 7-17 Wigwam or Teepee

Figure 7-18 Fallen Tree Shelter

7.4.3 Fire Starting

When building a fire and to avoid causing a forest fire, build in a sandy or rocky area or near water. Have available a source to extinguish the fire. The 4 most important factors when starting a fire are:

- Spark
- Tinder
- Fuel
- Oxygen

Spark:

- Water-proof, strike-anywhere matches, stored in a water-proof container are best.
- Cigarette lighter.
- Flint and steel - aim the sparks at a pile of dry tinder to produce a fire.
- An electric spark produced from a battery.
- Allow the sun's rays to pass through a magnifying glass

Tinder - should be dry, fine and highly flammable:

- Dry grass, paper, cloth, dryer lint, dry bark, dried plants are forms of tinder. Place your tinder in a small pile with the driest pieces at the bottom.
- Twigs, bark, shavings are necessary to ignite larger fuel.

Fuel - larger pieces of dry wood:

- Gather your fuel before attempting to start the fire to ensure that enough is on hand.
- Dry wood burns best. Wet or *pitchy* wood will create more smoke. Dense, dry wood will burn slow and hot.

Oxygen:

- A well ventilated fire will burn best.

7.4.4 Safety

To recap discussion points made in Section **7.4 Wilderness Survival**, prior to leaving home you should:

- Prepare a trip plan indicating where you're going, and how long you expect to be gone. Include where you're starting your trip, the vehicle you are using and equipment that you're taking with you.
- Always carry a few basic items in case you have to stay overnight. These include, garbage bag, lighter, whistle, pocket knife, water bottle (and purification tablets) and snacks. More items should be added for more extensive hiking.
- Basic gear and clothing appropriate for the weather now and when the temperature dips at night.
- Make sure that your head is covered. Heat loss is greatest though uncovered head.
- Carry a compass (with a sighting mirror – mirror can be used for signaling).

- Know your limits. When it is time to rest, stop and take a break. Turn around and head back when you are ready; you are the best judge as you know your physical limitations.
- Maintain a positive mental attitude.

Some essentials to carry with you could be:

- Survival kit - should be:
    - Water repellent or waterproof and able to boil water in it.
    - Easy to carry or attach to your pack.
    - Able to accept a variety of sized items.
    - Be durable.

- Survival kit should contain:
    - First aid kit.
    - Water purification tablets or drops.
    - Fire starting equipment.
    - Signaling items.
    - Food procurement items (snare, fishing line with hook).
    - Survival gear.

Suggested items are not limited to the list above, though weight and size may be a determining factor.

NOTE

Plan and prepare before you leave home and you'll be ready for any unexpected event in the back country.

7.4.5 Signaling

In this section, topics that will be covered include survival signals and air to ground signaling. All techniques can be utilized in survival situations.

7.4.5.1 Survival Signaling

International Distress Sign is always a series of three repetitions of any signal (3 loud sounds, three fires, three flares etc.).

Items that can be used in times of distress are:

- Radio or cell phone.
- Fires - in open areas forming an equilateral triangle.
- Smoke - must contrast with the environment (dark smoke against snow, white smoke against dark ground cover).
- Light - flashlight or flares.
- Straight lines, right angles (branches laid out on the ground in the shape of an arrow).
- Flags
- Dyes - bright contrasting colours against dark vegetation.
- Whistles – 3 blows.
- Mirrors - reflective surfaces.
- Gunshots – 3 shots
- Electronic distress signals.

NOTE

Do everything possible to alter the natural look of the terrain you are in.

Figure 7-19 Signal Mirror

Figure 7-20 Signal Fire Construction

Figure 7-21 Signal Fire (Lit)

7.4.5.2 Ground to Air Signaling

Personnel on the ground can communicate many things to the aircrew without ever truly talking to them. This is accomplished by using ground to air emergency codes.

Figure 7-22 5 Primary Ground to Air Signals, illustrates the current signals recognized internationally. These can be made by survivors or ground search teams to indicate their current status. Signal paulins, tarps, tracks in the snow or dirt, other distinguishable means can be used to draw these markings on the ground. Be careful to make sure that your signals are large enough to be seen and if multiple signals are used, do not make them confusing. Remember that the aircrew may not be looking at this from the same perspective as you, and this could cause many unnecessary delays.

Figure 7-22 5 Primary Ground to Air Signals

7.4.6 Psychology of Survival

In this section, topics that will be covered include enemies of survival and survival patterns. All techniques can be utilized in survival situations.

7.4.6.1 7 Enemies of Survival

Fear and panic, pain, cold, thirst, hunger, fatigue, boredom and loneliness are enemies of survival. In a survival situation, these feelings are more severe and more dangerous than in normal situations. Having knowledge of these feelings and their effects can assist in overcoming and controlling them.

Fear and panic – factors that increase fear are helplessness and hopeless. Being prepared, having confidence and concentrating on the jobs that need to be done will decrease your fear factor and your level of panic.

Pain - is nature's way of identifying problems. Pain can however, subside if one is preoccupied. Pain may go unnoticed if one's mind is occupied with plans of survival. Once a person gives into pain, it will weaken the drive to survive. A special effort should be made to keep ones hopes up and keep working.

Cold - lowers the ability to think and will to complete necessary tasks for survival. Focusing on being cold can interfere with the goal of survival. Cold can numb both the mind and body. It can also lead to serious medical problems. Find ways to get and stay warm, like building a fire, getting dry, layering clothing and keeping busy.

Thirst - water is vital for survival. Dehydration can lead to serious medical problems and can eventually be fatal. Even when thirst is not extreme, it can dull the mind. Drink regularly, and try to find sources of water.

Hunger - is dangerous because it can lessen the ability for rational thought. Both thirst and hunger increase a person's susceptibility to the weakening effects of cold, pain and fear. Prolonged hunger can lead to serious medical problems and can eventually be fatal. Manage food supplies, set snares, fish and collect edible plants.

Fatigue - even a moderate amount of fatigue can reduce mental ability. Fatigue can make people careless as it becomes increasingly easy to adopt the feeling of just not caring. This is one of the biggest dangers in survival. While fatigue can be caused by overexertion, it may also be caused by hopelessness, losing sight of goals, dissatisfaction, frustration or boredom. Fatigue may represent an escape from a situation that has become too difficult. Recognizing the dangers of a situation can provide the strength to go on. Watch exertion levels, set goals, and stay busy.

Boredom and loneliness - represent the final the enemy of survival. They are perhaps 2 of the toughest enemies of survival, mainly because they are unexpected. When nothing happens, when something is expected and does not happen, or when one must stay still, quiet, and alone, these feelings develop. They can cause discouragement and a lack of will to go on. Invent games, stay active and create projects.

One of the most important requirements for someone in a survival situation is the ability to accept the reality of the situation and react appropriately. If you are able to react calmly to a survival situation and develop a sensible plan, you are more likely to experience success.

7.4.6.2 Survival Pattern

Survival pattern is a procedure used in a survival situation. It is a way of prioritizing tasks. The pattern is presented in a particular sequence; however the pattern can vary depending on the situation and changes in priority. For example, if you become lost while hiking with a group, the first procedure in the pattern should be to signal (blow your whistle) because there are people nearby.

First aid - the most important thing to address in a survival situation is any injury that may have been sustained. Treating injuries can prevent conditions from worsening and reduce pain. Treating injuries allows for more involvement in survival activities.

Fire - serves many purposes in a survival situation. It can provide warmth, boost morale and provide a sense of security. It is a method for creating signals, drying clothes and can help purify water and cook food.

Shelter - allows a person to be warm and dry by providing protection from the elements. Even if the current weather conditions are favorable, it is not always possible to know when and how the weather conditions may change. Therefore, building a shelter early is very important. It also provides the psychological comfort of having a home base.

Signals - should be constructed to attract search teams. Signals can take many different forms. Signal fires with heavy amounts of dark smoke are visible from a long distance away during the day or night. Other ground to air signals should be large and stand out from the surroundings, or be placed in nearby open areas. A mirror or another reflecting object is an excellent tool for signaling.

Food and water - survival without water will only last a few days. Lack of water can lead to mild dehydration, which can reduce the ability to concentrate. This in turn can be dangerous, as clear thinking is essential in a survival situation. Water from any ground source should be purified before drinking. A person can live for weeks without food. Excessive hunger can cause confusion and lack of judgment. Prolonged starvation will result in loss of energy, loss of mental clarity, increased susceptibility to disease, difficulty maintaining body temperature and eventually death. A balanced and varied diet can improve morale in a survival situation.

All of the basics can be summed-up in *The Rule of Three,* which states that in the absent of sudden death (accident) or terminal illness, your survival is generally contingent upon not exceeding:

- 3 minutes without breathing (drowning, asphyxiation).
- 3 hours without shelter in an extreme environment (exposure).
- 3 days without water (dehydration).
- 3 weeks without food (starvation).

It is essential to maintain a *positive mental attitude*. This includes the *will to live.*

In any survival situation, some points to remember:
Rest - Proper and timely periods of rest conserve body energy for use later. Mental rest is just as important as physical rest. Extreme stress will reduce survival time.

Water - is essential to regulate body temperature and to assist with digestion of food and waste elimination. To carry on normal daily activities, the body requires 2 liters of water a day. Untreated water should be boiled or treated with purification tablets. In winter, though open water is preferred, melted snow or ice can be substituted. Avoid eating snow as it can cause hypothermia by lowering the body's core temperature.

Food - Within the body, energy levels play an important role in maintaining warmth and providing optimal performance. Before using rations, check for known obtainable natural food sources. Stress can impact on the important vitamins and minerals stored in the body.

Improvising - Produce or make (something) from whatever is available. Recognize what is required and decide how to rectify it. Be positive. Prioritize your needs so time and energy are not wasted. Improvise from what you're wearing, carrying or from items in the environment.

Foraging - As a general rule, all fur-bearing animals are edible. All grass seeds are edible. All birds are edible.

- Hunting and fishing - stay close to the camp as you'll waste energy.
- Snares - used primarily for small game but can be used for larger animals.

Using the acronym ***STOP*** will help when under stress

- **S** – Stop. Helps fight panic/anxiety. At the first sign of danger or disorientation, stop for a moment so you can think.
- **T** – Think what dangers either immediate or long term may occur. Analyze the weather patterns, terrain and available food and water sources. If a map is available, try to determine your location. Do not make hasty judgements.
- **O** – Observe. Size up the situation for possibly solutions. Look for hazards. How much time do you have before dark, and what is available to work with.
- **P** – Plan your course of action to best utilize your energy. Take advantage of the natural and ready resources available to you. Consider the priorities to maintain life.

Practical Exercise
As a group, prepare for a back country hike. After 1 hour of searching for either clues or following a specific coordinate, have the group stop and set up for the night. The leader will assign specific tasks to each person. These will include determining the best site for the night, gathering wood, building fires and shelters, heating water etc. Stay for the night working together to solve any issues as they develop. Hike out the next day. Debrief any problems and possible solutions.

7.5 Navigation

This section will cover all elements required to navigate while conducting SAR operations. Topics include map reading, compass skills, GPS skills and the tally system.

7.5.1 Map

OBJECTIVE: As SAR responders, we need to be able to make sense of and rationalize the physical area within which we will be searching. There are many modern methods, tools and presentations which can help us in that need. These include, but are not limited to, satellite images viewed through Google Earth, digital maps including 3D displays, devices such as iPhones, iPads, GPS and other very portable devices.

A command post planning map however is frequently a conventional map, commonly referred to as a *paper* map. Maps handed out to SAR members during the course of a search, may be of the actual type commercially available or may be copies, printed as required.

It is therefore necessary that searchers become familiar with all facets of these *paper* maps so that they can interpret them correctly during the search. A quick and accurate *reading* of a map assists in keeping searchers safe and expediting our main task of finding the missing or lost person(s).

7.5.1.1 Map Types

Maps are produced for many end uses; some examples may include:

- Road maps
- Marine maps (commonly called charts)
- Aeronautical maps
- Topographical maps (most common map utilized for SAR operations)

Topographic Map Defined - A topographic map provides a complete and accurate representation of the ground, including its natural and man-made features as it existed for the date the map was produced.

Details - Topographic maps available for Canada are referred to as National Topographic System (NTS) maps. They are available in digital and *paper* formats. The map data required to produce these maps has been acquired over time through various methods including aerial photography, satellite imagery, on the ground surveys etc. The data is the property of the Canadian Government. Maps are produced in various scales with the most common for ground SAR being 1:50,000 scale. Others might include 1:20,000 or 1:250,000.

When a cartographer produces a map, they must select a method of projection for that map. The method chosen for these topo maps is the Universal Transverse Mercator (UTM) system of projection, hence the UTM grid.

7.5.1.2 Scale

To make a map useful, a cartographer establishes and indicates a consistent relationship between size on the map and size of the real world. This relationship is the map scale. For instance, a map may use 1 unit on the map to represent 50,000 units in the real world.

This map would then be referred to as a 1 to 50,000 scale map or 1:50,000 or 1:50K. If you put your foot down on this map, you would then have to put your foot down 50,000 times in a row to cover the same distance in the real world. To help visualize this, a common reference for a map is the number of centimeters equal to 1 kilometer. In the 1:50k map, this translates to 2cm equals 1km. To reinforce this, a graphic linear scale is printed on the map (usually at the bottom). Additional graphics are usually shown for other units of measure such as miles and meters.

Large Scale vs. Small Scale - The reference to *large scale* or *small scale* as it relates to topographic maps can be visualized in this way. Compare a 1:50K (*large scale*) to a 1:250K (*small scale*). A large scale map covers a smaller area of the earth per sheet than its cousin the small scale map. Sounds contradictory but it is not! The larger scale map will show features such as lakes as being larger. In a nutshell a larger scale map covers a smaller area in larger detail.

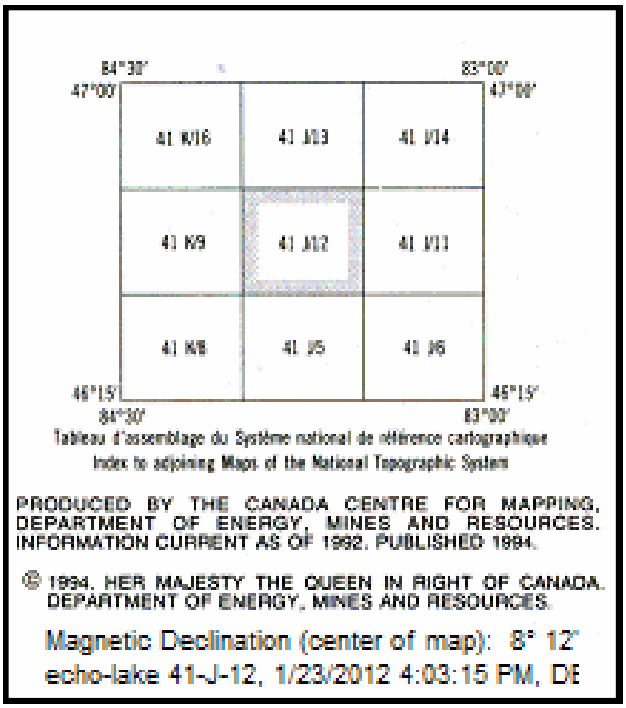
7.5.1.3 Measuring Distance on a Map

On the 1:50K maps used during ground SAR operations, a quick visual reference is to focus on the grid boxes that typically appear as light blue in color and can be used as a ready reference for distance on the map. The straight across distance for each box is 1000 meters or 1 kilometer.

The graphic linear scale at the bottom of the map can be used in a variety of ways. A measurement can be taken from A to B and the ruler (your compass has a ruled section on the base plate) transferred to the scale. A pair of dividers can also effectively transfer the distance in question to the graphic linear scale. A piece of paper can be placed on the map and two tick marks representing points A and B transferred down to the graphic scale.

7.5.1.4 Adjoining Maps

An index to adjoining maps is typically printed in the margin of these topographic maps. This can be used as a key to selecting adjoining maps by number. Note that the adjoining map names are not depicted in this index.


84°30'
83°00'
47°00'
47°00'
41 K/16
41 J/13
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41 K/9
41 J/12
41 J/11
41 K/8
41 J/5
41 J/6
46°15'
46°15'
84°30'
83°00'
Tableau d'assemblage du Système national de référence cartographique
Index to adjoining Maps of the National Topographic System
PRODUCED BY THE CANADA CENTRE FOR MAPPING, DEPARTMENT OF ENERGY, MINES AND RESOURCES. INFORMATION CURRENT AS OF 1992. PUBLISHED 1994.
© 1994, HER MAJESTY THE QUEEN IN RIGHT OF CANADA. DEPARTMENT OF ENERGY, MINES AND RESOURCES.
Magnetic Declination (center of map): 8° 12'
echo-lake 41-J-12, 1/23/2012 4:03:15 PM, DE

Figure 7-23 Adjoining Map Index

7.5.1.5 Map Names and Numbers

All NTS maps are assigned a name and number. The name usually relates to some nearby town, lake etc. The number of the map will be centered and shaded as shown in the map index above. It will also appear in bold print at the bottom centre of the map and in the right hand bottom corner.

7.5.1.6 Map Datum

The reference data used by cartographers to produce maps is dated 1927, 1983, and 1984. It is called *map datum* and is a term used to describe the baseline or start position from which all positional detail appearing on the series of maps is referenced. Maps in use today would typically have 1 of 3 datums:

- North American Datum (NAD) 27
- NAD 83
- World Geodetic System (WGS) 84

NAD 83 and WGS 84 are considered equal. The map datum can be found in the margin of the map (small print and not easily seen). An edition number can also be referred to.

NOTE

It is important that all participants in a search have maps of the same edition/datum and also that GPS units be set to this datum.

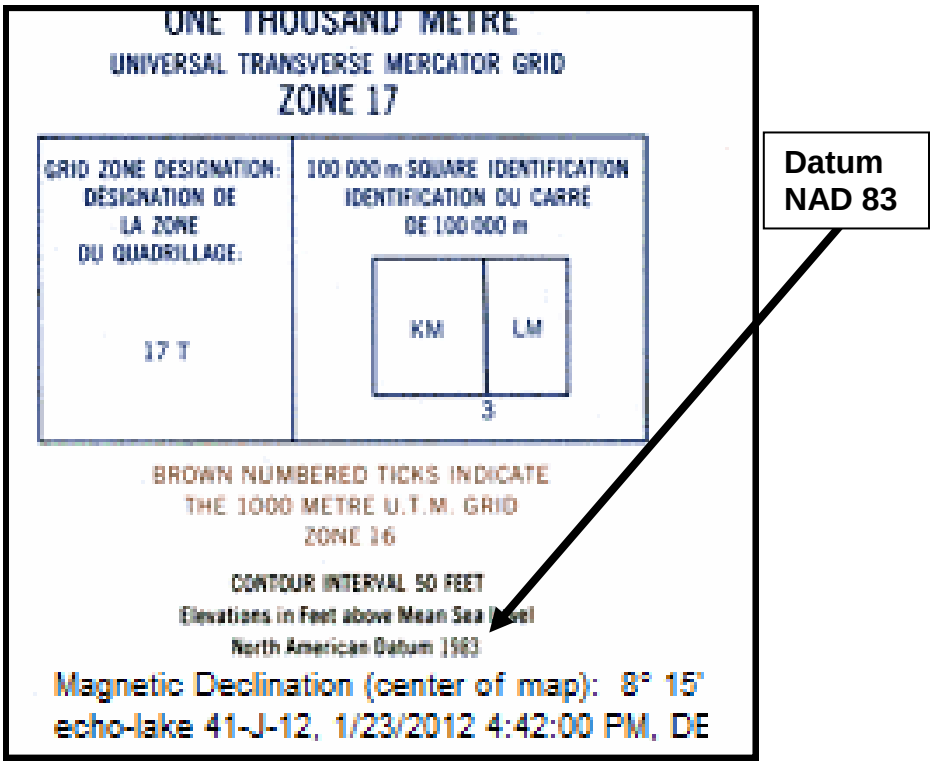

Figure 7-24 Map Datum / Edition

Grid Zone and 100,000m ID - Notice in ***Figure 7-24 Map Datum / Edition*** that Grid Zone 17T and 100,000m ID are shown. If you are inserting MGRS coordinates in a GPS you must include these in the prefix.

NOTE

For the 100,000m ID in this example (as shown above), it will be either KM or LM, not both – it is dependent on where you are on the map.

7.5.1.7 The 3 North's

True North - is where the meridians of longitude converge at the North Pole. The vertical lines at the right and left edges of the map are aligned with True North.

Magnetic North - is not in the same place as the True North Pole. Its position varies from year to year and is not really a place but rather a direction in which a compass needle points when free of error. There are no lines on the map aligned with magnetic north.

Grid North - is the northern direction of the north/south UTM grid lines (the vertical lines forming the grid boxes (light blue in color) on the map). They are aligned with Grid North. You may refer to these when taking bearings from a topo map.

7.5.1.8 Bearings

When bearings are taken from these maps, the vertical grid lines are used as a line of reference. For example, if we took a bearing from A to B of 090º, our objective would be to travel eastward. The grid lines which were used as a line of reference are not aligned with Magnetic North. Before we use the compass to travel, an adjustment must be made to account for the difference between the two. The difference is called the *grid magnetic angle*. The following graphic found in the margin of the map shows that the difference for this map as of 1994 was 8º 52’ (between Grid and Magnetic North) and has been increasing 4.8’ since then. Over 18 years the increase has totaled 18 X 4.8’ = 86’ or 1º degree 26’. The increase is added to the original and the total GMA this year is 10º 18’. This should not be taken as an absolute but rather a reasonable approximation.

NOTE

The copy of this graphic was taken from a digital map and the software has indicated that the *declination* (difference between True and Magnetic North) is currently 7 º 49’. If you add the 2º (shown as 1º 60’) to the declination value you get 9º 49’.

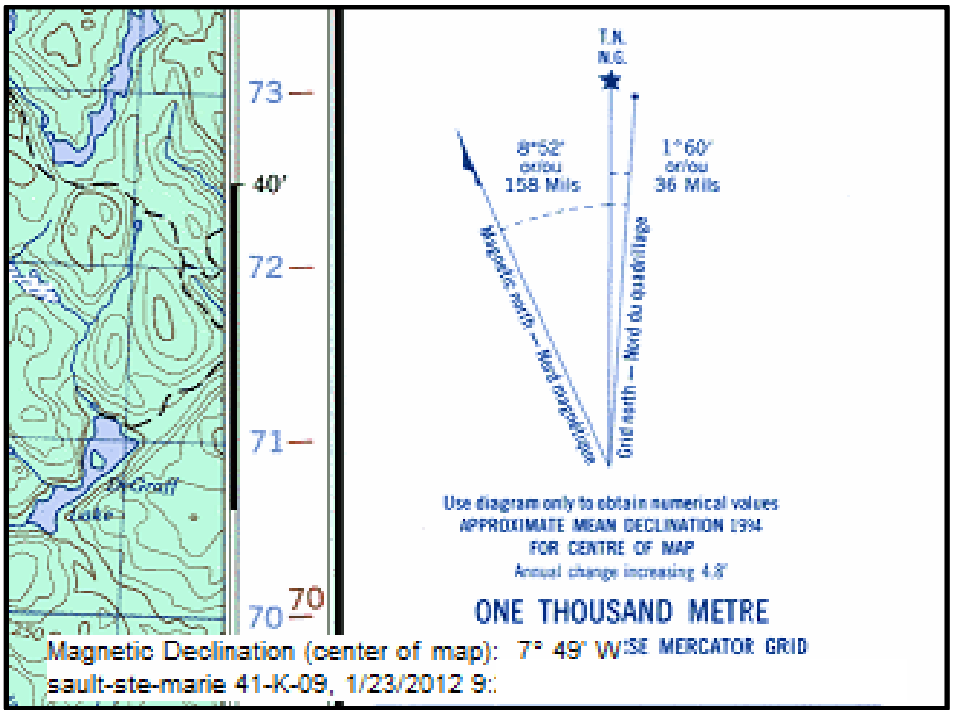

Figure 7-25 Magnetic Declination

NOTE

The graphic showing the 3 North’s is intended to show the trend; that is Magnetic North is to the left or west of Grid North. This graphic is not to be used as an accurate representation of the angle.

Adjusting the compass - Before we begin walking on a course of 090º, we would adjust in 1 of 2 ways:

- Permanently adjust the compass with the small screwdriver provided (attached to lanyard) to 10º west. Dial the compass to 090º and start walking.
  OR
- Add the 10º to the original 090º (use an *unadjusted* compass). Dial the compass to 100º and start walking.

Rule – west is best so we add.

7.5.1.9 Map Colours

Basic colours are used to denote various types of surface features on topographic maps:

- Black – Man-made objects such as buildings, bridges, power lines, railway lines etc.
- Red – Main roads, some buildings, red screen for built up areas.
- Blue – Water, marsh.
- Green – Vegetation, forestation.
- Brown – Contour lines, sand, secondary roads.
- White – Open areas, no forestation.
- Purple – Areas new to the map.

Contour Lines and Contour Interval - Contour lines join points of equal elevation. Every 4th or 5th line will be thicker. Contour lines help us visualize the *relief* or the high and low spots in the terrain. These lines assist us in deciding which route to take when considering our safety and speed of travel. A notation in the margin of the map will indicate the interval between contour lines. In this map it is shown as 50ft.

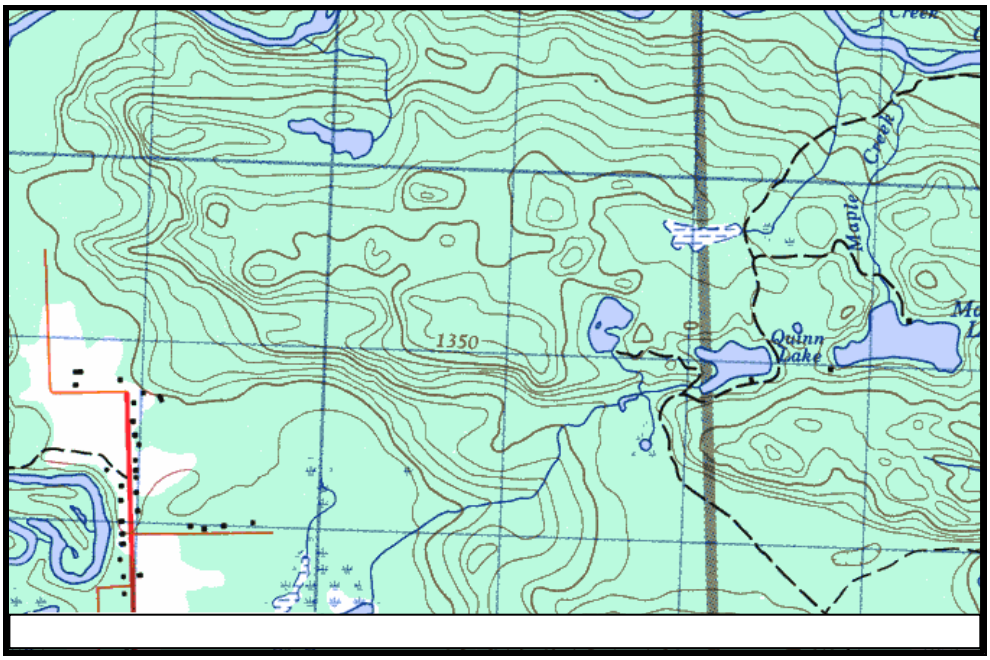

Figure 7-26 Contour Lines / Intervals

Notice near the centre of the map the *1350* reference elevation. It is the highest point in this area and can be interpreted as 1350ft above sea level. If you proceed generally southward toward the creek and deduct 50ft for each contour line crossed, the creek will be at 1050ft or a descent of about 300ft (too steep to transit across). Contour lines that are close together indicate a steep slope. Newer maps show elevation in meters.

7.5.1.10 Coordinates

To document your position on the earth, a tactic commonly used is to state your location at the intersection point of two lines of position, hence the name *coordinate,* as an example you could say " I am at the intersection of Second Line E and North St". Or another example would be that your position is at a point where the 46º north parallel of latitude intersects 84º west meridian of longitude. The Lat/ Long can be expressed to a higher level of accuracy (i.e. 1 º equals 60' and one minute equals 60"). Therefore your position might be at a point of intersection at 46º 21' 54" north latitude and 084º 54' 35" west longitude.

NOTE

Remember that the 2nd and 3rd set of numbers can never be more than 59.

The leading zero in the longitude *084* is a place holder for clarity because this number may be 3 digits on occasion. This historic method of defining a place on earth is currently in use for aeronautical and maritime navigation. The province of Ontario is located in north latitude (north of the equator) and a west longitude (west of the prime meridian). When a position is stated in Lat/Long, it will include degrees, minutes and seconds, where 1º equals 60' and 1' equals 60".

7.5.1.11 Marine and Air Navigation

The Lat/Long system of coordinates is currently the favored method for marine and air navigation. The latitude and longitude scales are printed around the map borders and the common reference to 1 minute of latitude being equal to 1 nautical mile is routinely used.

NOTE

Coast Guard and DND aircraft use decimal minutes instead of seconds - example 46º 33 decimal 90' or 084º 47.10' – referred to as degrees, minutes and decimal minutes.
The decimal minute expression converted would be 0.90' X 60 = 54" and 0.10' X 60 = 06".
Resulting in the more customary degrees, minutes and seconds expression.
46º 33' 54" 084º 47' 06".

Latitude – Longitude Impractical for GSAR - Quickly locating a coordinate position on a topographical map when the position is expressed in Lat/Long is both time consuming and awkward. The map must be fully opened and at a minimum, a pair of dividers is required as an aid.

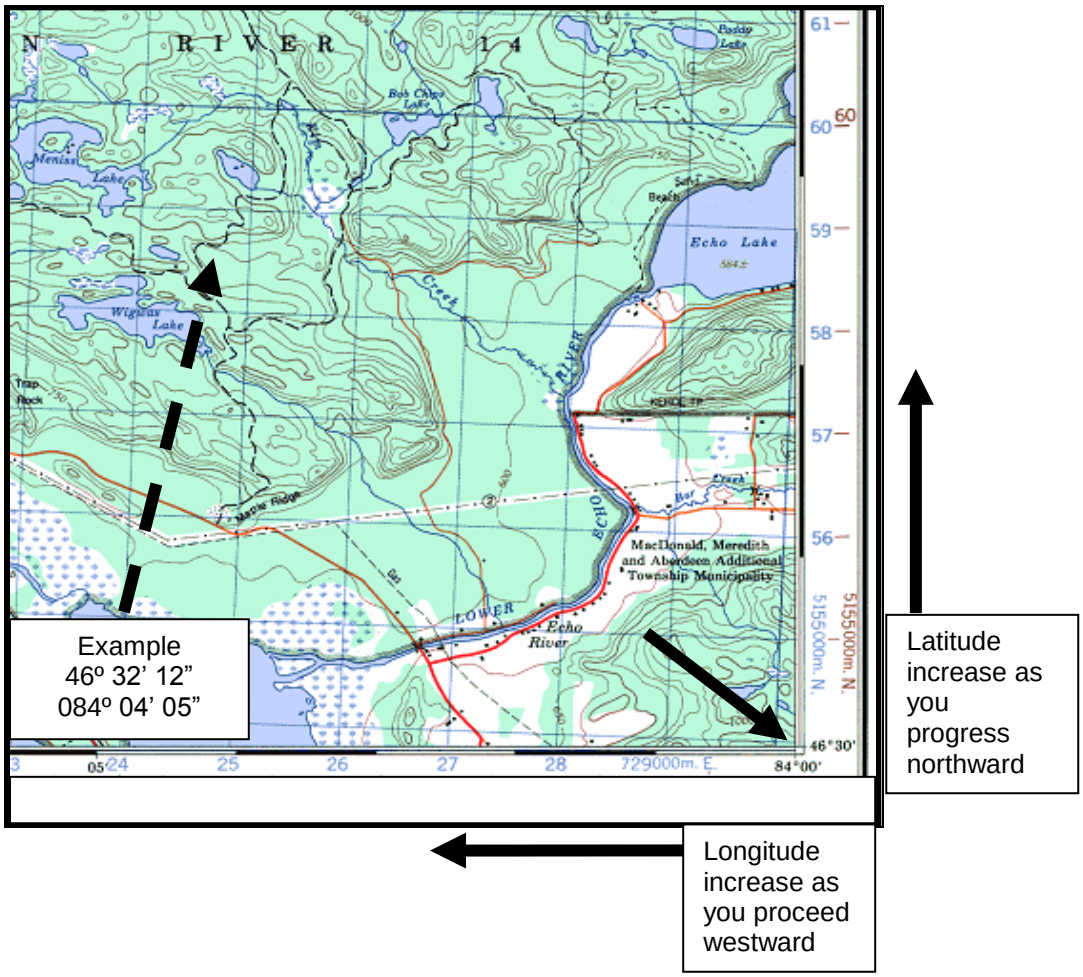

Figure 7-27 Latitude - Longitude

7.5.1.12 GSAR Navigation

The coordinate system used during GSAR operation/deployment is called the Military Grid Reference System (MGRS). It is derived from the Universal Transverse Mercator (UTM**)** grid system. MGRS is an abbreviated version of UTM (fewer numbers but more letters). A typical MGRS coordinate would be as shown:

- 16T GS 28500 68910 (from NTS map 41K9).

A GPS would display the 5th number in each group (accuracy to 1 m). Disregard the 5th (last) digit for plotting your position. If you are trying to input this coordinate into a GPS, the 5th digit is required. The 4 digit example is accurate to 10 meters. To quickly find this on a map, find easting line 28 and the northing line 68. This intersection is the bottom left (SW) corner of the box you are in. You are 5/10 east of the 28 easting line in the grid box and 9/10 north of the 68 northing line in the grid box. You will focus on the first 3 numbers in each display to accomplish 100m accuracy. No tools needed to accomplish this**.** If you want to plot to 10m accuracy, a romer can be used.

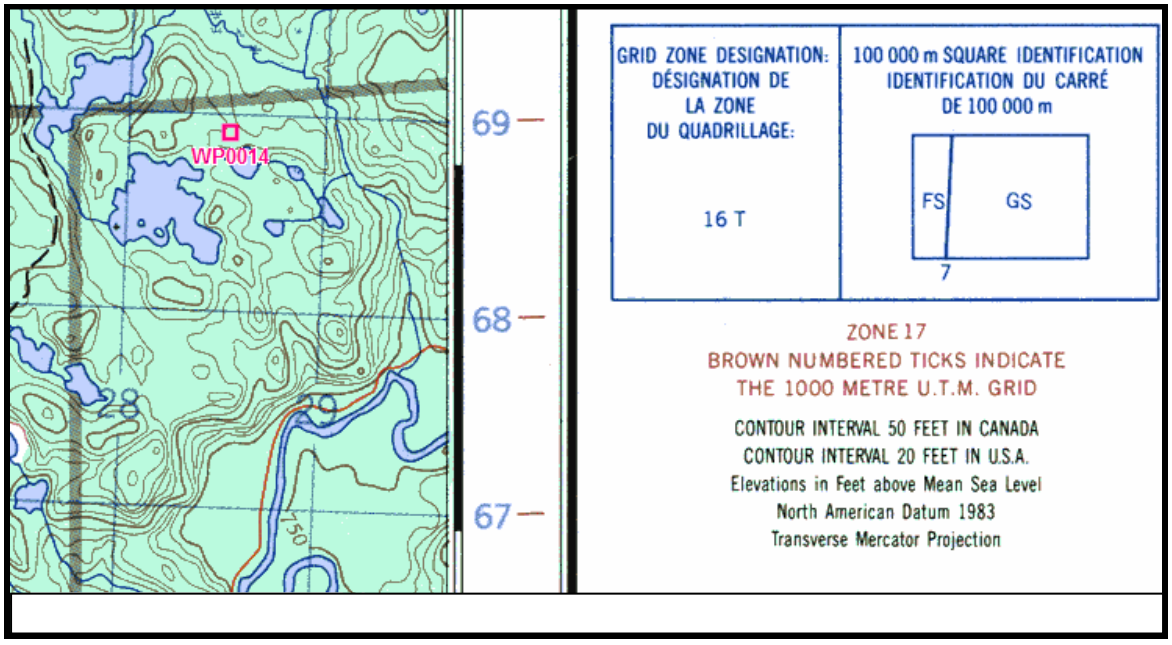

Figure 7-28 MGRS

Notice the graphic to the right – this will assist when required to input coordinates into a GPS. The 16T and GS are required for this map.

7.5.1.13 Romer

See ***Figure 7-29 Romer*** - Notice in the upper right corner the 1:50,000 scale. This can be used to determine a position within a grid box to an accuracy of about 50m or half the distance between the numbered lines. A similar romer is etched onto the base plate of many compasses.

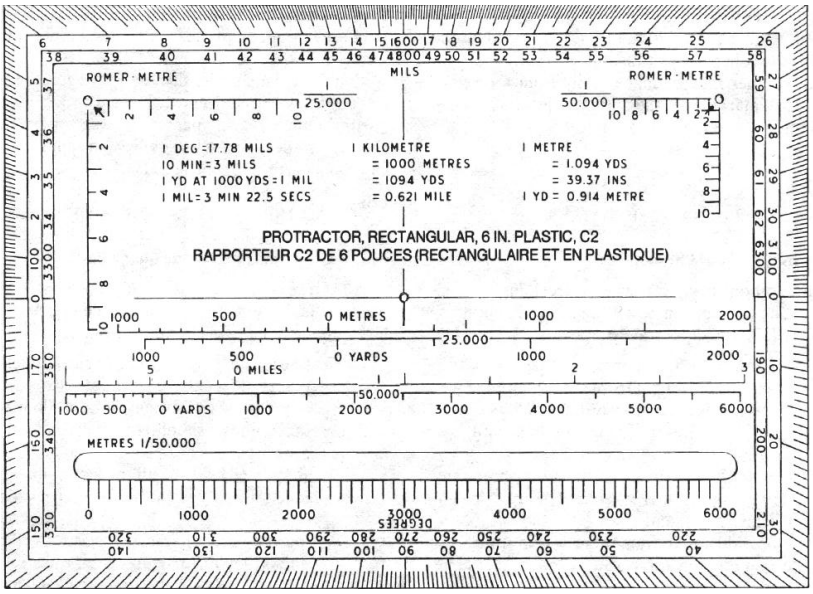

Figure 7-29 Romer

In the following example, the easting value would be 9160 and the northing value would be 9440.

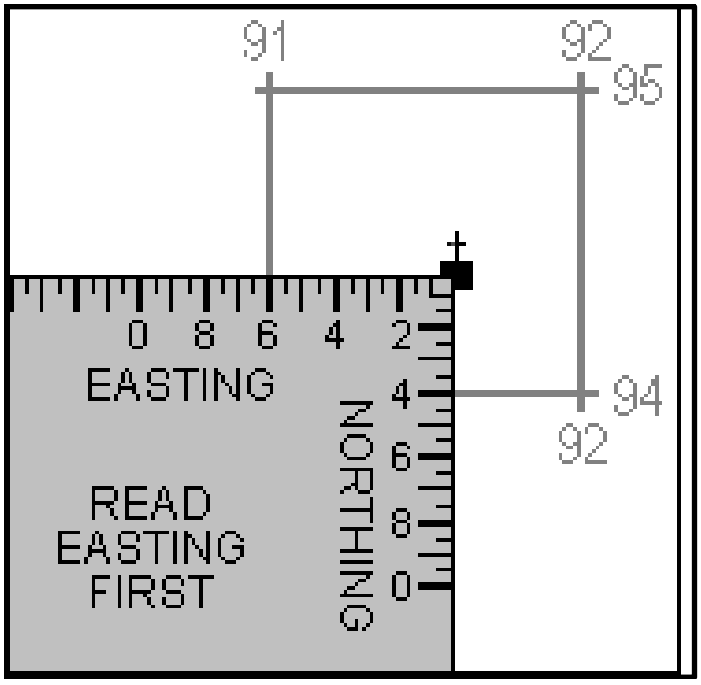

Figure 7-30 Reading a Romer

A catch phrase used when doing this is - *in the door* (easting) *and up the stairs* (northing). The easting coordinate is always named first followed by northing coordinate.

7.5.1.14 Map Symbols

A diverse set of symbols is used on these topographic maps to illustrate many features and objects, anything from buildings to swamps. Many topo maps have a full set of symbols printed on the back or side (margin) of the map. Searchers attempting to *read* a map must become familiar with these symbols. ***Figure 7-31 Map Symbols*** is a representative sample of typical symbols found on topo maps.

Figure 7-31 Map Symbols

7.5.1.15 Describing Direction

To convey direction in reference to a map, a custom of referring to cardinal points, north, south, east and west is well recognized and accepted. In general terms, when we hold a map right side up, the north edge is at the top and south edge at the bottom. This is known as *north up*. Each of these cardinal directions has a numeric equivalent, starting at north 000º or 360º, east 090º, south 180º and west 270º. These are all sectors of a complete circle (360º).

NOTE

When stating a 2 digit value, the leading zero is inserted. This is for clarity. For example to state your direction between north and east, you would state 045º. Typically directions on a map can increase or decrease in 1º increments (045º to 046º to 047º). Most modern compasses will adjust to 2º degree accuracy.

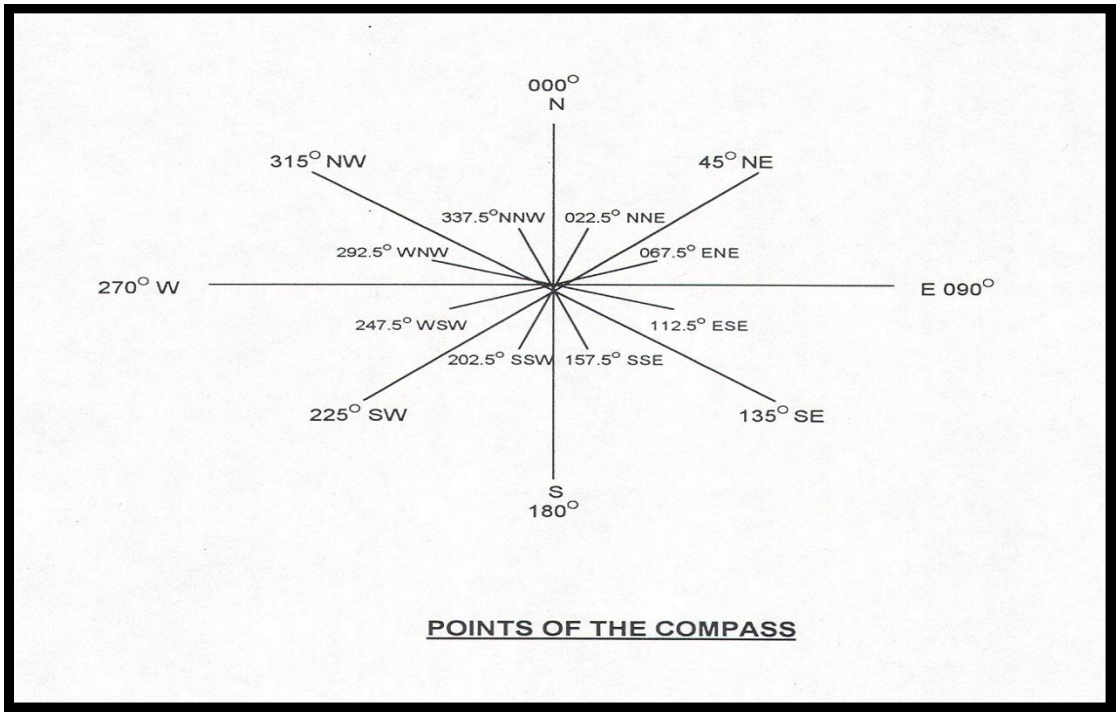

Figure 7-32 Cardinal Points

7.5.1.16 Taking a Bearing from a Map

A bearing taken from a map involves identifying a start point and end point A line is drawn or imagined from these 2 points. A protractor or compass being used as a protractor is placed on the map in the direction you would travel. In reference to the grid lines, the bearing will be at an angle between 000º and 359º. Procedure when using a compass:

- Take out your compass and open flat.
- Place the compass on the map with the top pointing in the direction you want to travel.
- Align the side of the compass with your start and end points.
- Turn the compass dial so north points to the top of the map. Align the meridians parallel with the easting grid lines.
- Read the number at the orienting point; that is your bearing.
- Remember that before you proceed you must adjust for the GMA.
- The magnetic needle is not referred to during this process.

Figure 7-33 Taking a Bearing from a Map

7.5.1.17 Map Care

During SAR operations or training sessions, maps will be exposed to the environment. Paper maps degrade quickly when wet. Some map manufacturers produce a map made from a product called *Tyvek*® (a high-density polyethylene (HDPE) material) which is much more durable but more expensive. Simple measures can help reduce the wear and tear on maps. Zip lock bags are sold in a variety of sizes and will serve as a protection for maps. Avoid writing on maps whenever possible and if needed, use a soft pencil. Erase when information is longer required.

Maps printed on Tyvek®, are ideally suited for outdoor use and include the following features:

- Waterproof.
- Tear-resistant (not impossible to rip, but very challenging).
- Flexible (these are not laminated).
- Light weight.
- Float.
- Can be folded and re-folded many times without damaging map.

Folding a map - Best folded so it can be opened like a book.

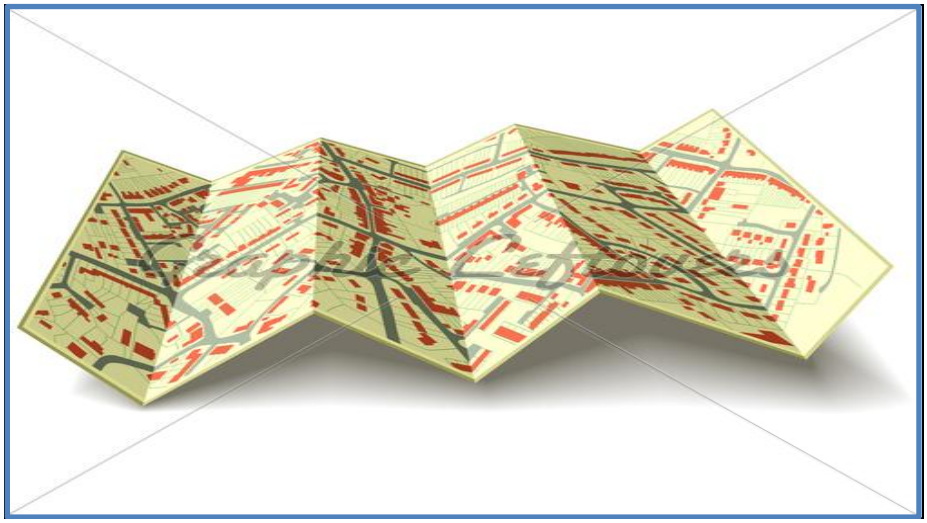

Figure 7-34 Map Folding

Suggested team protocol:

- Ensure that command post map and team maps have same datum information.
- All teams are issued a map (NTS paper or digital copy).

Best practices:

- Learn the practice of estimating, calculating and then navigating.
- Issue zip lock bags to protect maps.
- Develop desktop worksheets for classroom map set.
- Develop common terms, short forms for notation (i.e. datum, LKP, POD).

Problems:

- Paper maps are essentially 2 dimensional.
- Many area NTS topo maps are still NAD 27.
- Existing detail (roads, trails, power lines) not on map.
- MGRS ID errors.

7.5.2 Compass

OBJECTIVE - To provide searchers with a basic understanding and principles of a compass and its use when navigating.

7.5.2.1 History

The magnetic compass is an old Chinese invention probably first made during the Qin dynasty (221-206 B.C.). Magnetized needles used as direction pointers instead of the spoon-shaped lodestones appeared in the 8th century AD, again in China. Between 850 and 1050 they seemed to have become common as navigational devices on ships. The first person recorded to have used the compass as a navigational aid was Zheng He (1371-1435), from the Yunnan province in China, who made seven ocean voyages between 1405 and 1433.

Given the recent development of several modern day tools such as electronic compasses, GPS devices, cell and satellite phones, it is no less than amazing that we still look to the compass as a reliable tool for navigation. The basic compass is a tried and proven device that requires no batteries and the learning curve is not too steep.

7.5.2.2 Compass Type and Style

Figure 7-35 Compass depicts the type and style of compass utilized during GSAR operations and training.

Figure 7-35 Compass

Some typical features include:

- Balanced for northern and/or southern hemisphere.
- Clinometer.
- Large mirror.
- Jewel bearing.
- Adjustable declination correction scale.
- Additional sighting hole for superior accuracy.
- Baseplate with magnifying lens and anti-slip rubber pads.
- Luminous two-color bezel ring.
- Detachable snap-lock in lanyard. Easy to detach for working with the map.
- Wristlock in the lanyard.
- Scale - cm or inch.

Compass parts – The compass has 2 main components; mirror and base plate. See ***Figure 7-36 Compass Parts*** for all other parts.

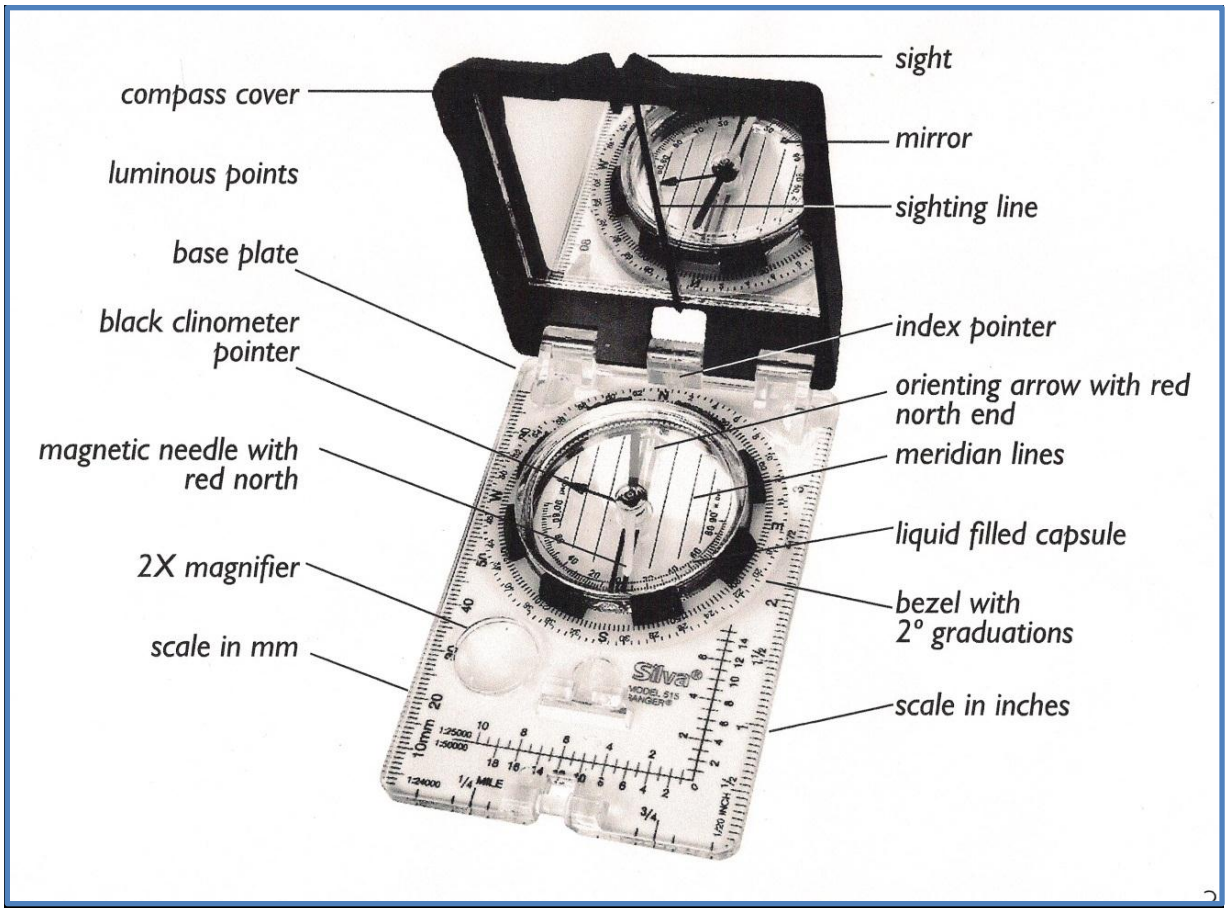

Figure 7-36 Compass Parts

7.5.2.3 Care and Maintenance of a Compass

Continuous exposure to UV sunlight should be avoided. Do not store on the dash of a vehicle for example (likewise for extreme heat). Do not Store a compass near electronic devices. Compasses are liquid filled; if a bubble appears, return for service, do not use. Check the compass dial periodically to ensure there is only minimal movement; loose dials should be sent for repair. Check the compass accuracy from time to time in known circumstances or with the assistance of a GPS.

7.5.2.4 Compass Basic Uses

- A compass of this type will typically orient its magnetic needle toward magnetic north so as the user you can see where magnetic north is.
- If the intended direction of travel is known, the user can *set* the compass to the direction intended and with proper use; the compass will *point* the way.
- As a protractor, the compass can be used with a map to determine the bearing from one point to another. The magnetic needle has no function during this operation.
- In the field, the compass can be used to site objects. With at least 2 objects sighted (3 is better), the reciprocal or reverse bearing can be used to draw lines on a map from the same objects. The lines will intersect at your position.

7.5.2.5 Describing Direction

Direction can be stated as a word description as shown ***Figure 7-37 Points of a Compass***. The *cardinal points* north, east, south and west are further divided by inter-cardinal points as shown below. In GSAR it is common practice to state the numeric value for the intended direction. The numeric value can be any number from 000º to 360º, which coincidentally are the same direction. If the direction is a single digit, for example 8º, leading zeros are added for clarity so it becomes 008º and is reported as zero, zero, eight degrees. In the case of a 2 digit direction, for example, 50º becomes 050º.

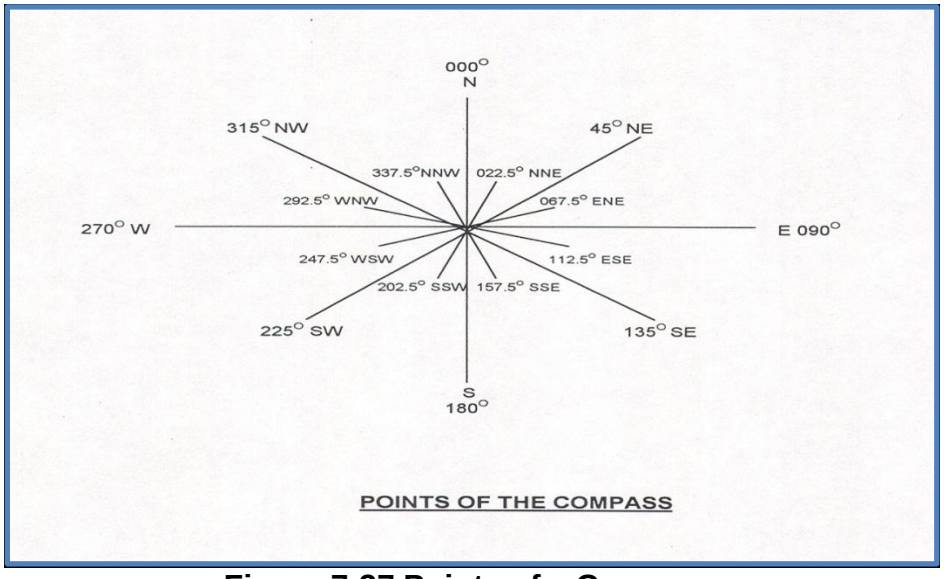

Figure 7-37 Points of a Compass

7.5.2.6 Compass Dial or Bezel Graduations

The compass dial is calibrated around its perimeter in 2º intervals as shown in ***Figure 7-38 Compass Dial / Bezel***. Starting at 0, the next numbered position clockwise will be 20 followed by 40 etc. Note the 30 position is not marked. It does however have a slightly longer indicator line to distinguish it from the other lines. The dial/bezel is luminous to assist searcher during night navigation operations.

Figure 7-38 Compass Dial / Bezel

7.5.2.7 Bearing

A bearing is an angle measured clockwise that a line makes with a fixed 0 line. That fixed 0 line is always north.

7.5.2.8 Obtaining a Bearing from a Map

Figure 7-39 Obtaining a Map Bearing, summarizes the procedure for obtaining a bearing from a map. Some key points to remember are:

- Start on point A and finish on point B (points must be known locations).
- If the distance between points is excessive, a pencil line should be drawn.
- The direction of travel arrow or mirror end is at the finish point.
- The compass bezel is rotated until the orienting arrow is *north up*.
- Orienting or meridian lines in the compass must be *parallel* to the grid lines on the map.
- The magnetic needle is of no consequence and not to be used when conducting this procedure.

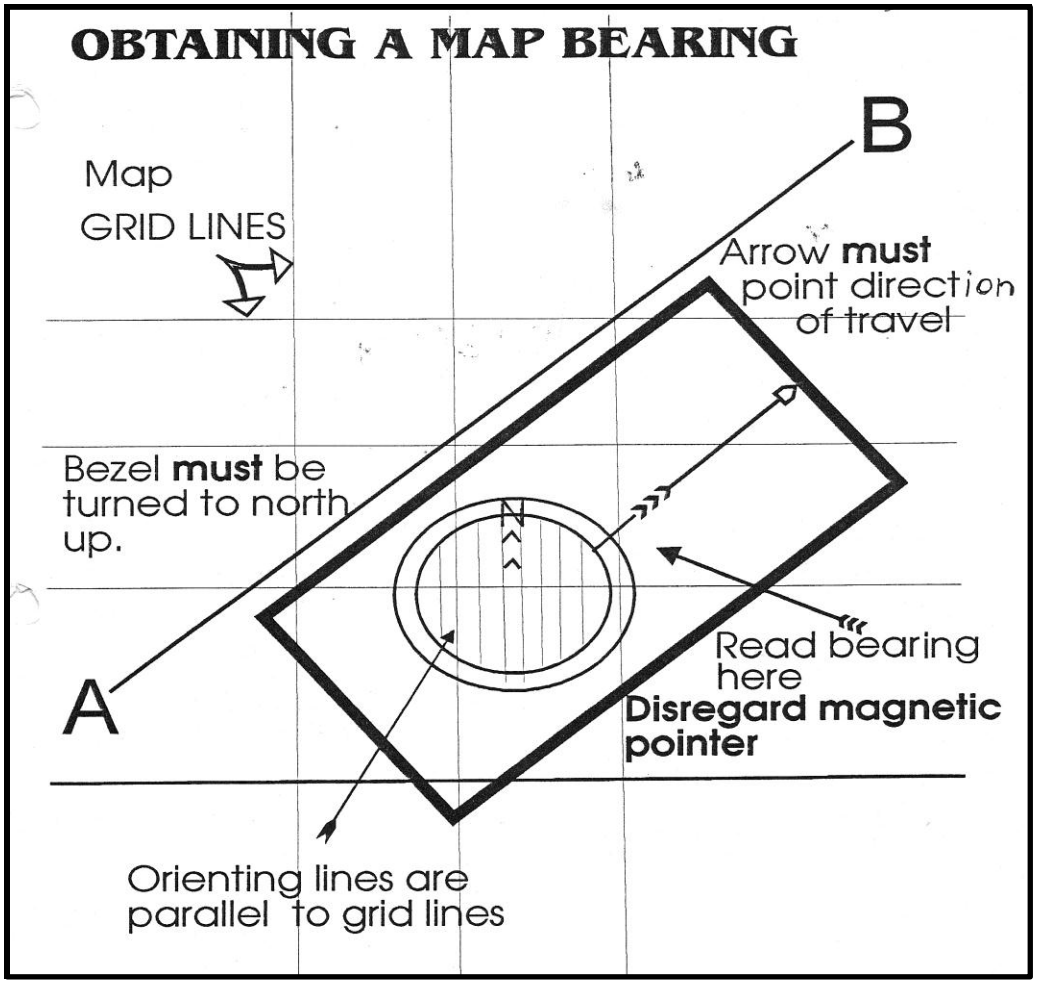

Figure 7-39 Obtaining a Map Bearing

Traveling from point A to point B - In the previous section, a procedure was outlined to determine the bearing from A to B. This bearing is called a grid or map bearing. To effectively travel in the real world from A to B we must *adjust* for the fact that the compass magnetic needle aligns itself with magnetic north or at the very least the magnetic north flux lines in the area.

We have used the vertical grid lines as the line of reference for the initial grid/map bearing. Grid lines are not aligned with magnetic north flux lines. We must now adjust the grid/map bearing a specific amount and a specific direction determined by observing the 3 North's graphic in the margin of the map. The 3 North's for the purpose of land navigation are:

- True North - The point through which the earth's axis passes, also known as the North Pole.
- Magnetic North - The direction in which a compass needle points when free of error. This is different from the North Pole. Its position varies from year to year.
- Grid North - The northern direction of the North-South grid lines on a map.

The adjusted bearing is called a *magnetic bearing.* The graphic displays the direction and amount that Magnetic North differs from Grid North. This is referred to as the Grid Magnetic Angle or GMA on a specific date.

An associated term known as *declination* is the difference between Magnetic North and True North. What is important for land navigation is the GMA**,** *not* the declination.

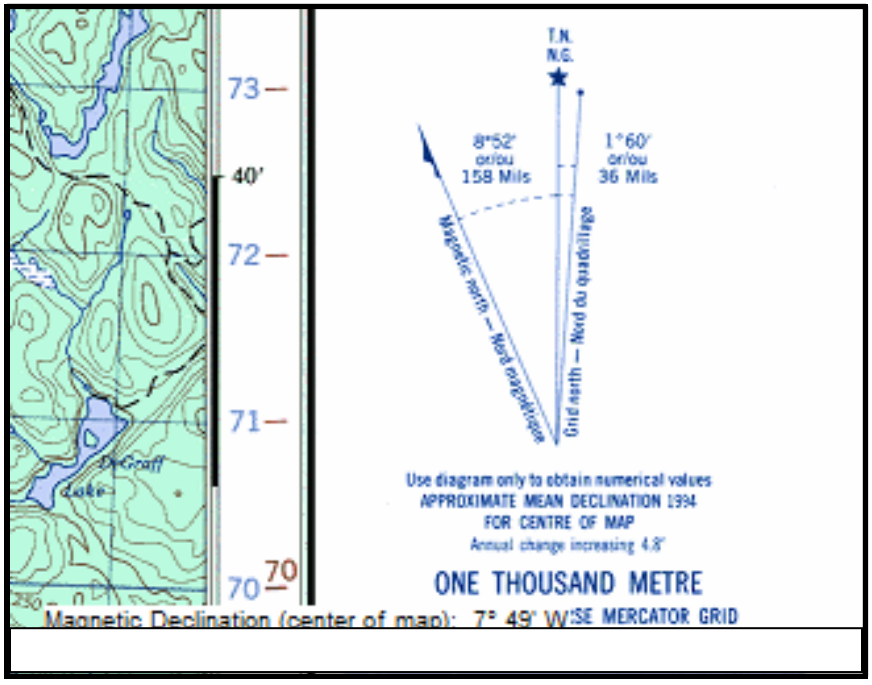

Figure 7-40 Magnetic Declination

7.5.2.9 Adjusting the Compass

Before we begin walking on a course we would adjust in one of two ways:

- Permanently adjust the compass with the small screwdriver provided to 10º *west.* This adjustment is recommended, especially if routinely working in the same area. (See ***Figure 7-41 Adjusting Compass Declination***)
    - View 1 – Compass not adjusted.
    - View 2 – Compass adjusted to 10º west.
    - View 3 – Adjustment screw shown.

- An alternative is to add the 10º west to the original bearing and use an unadjusted compass.

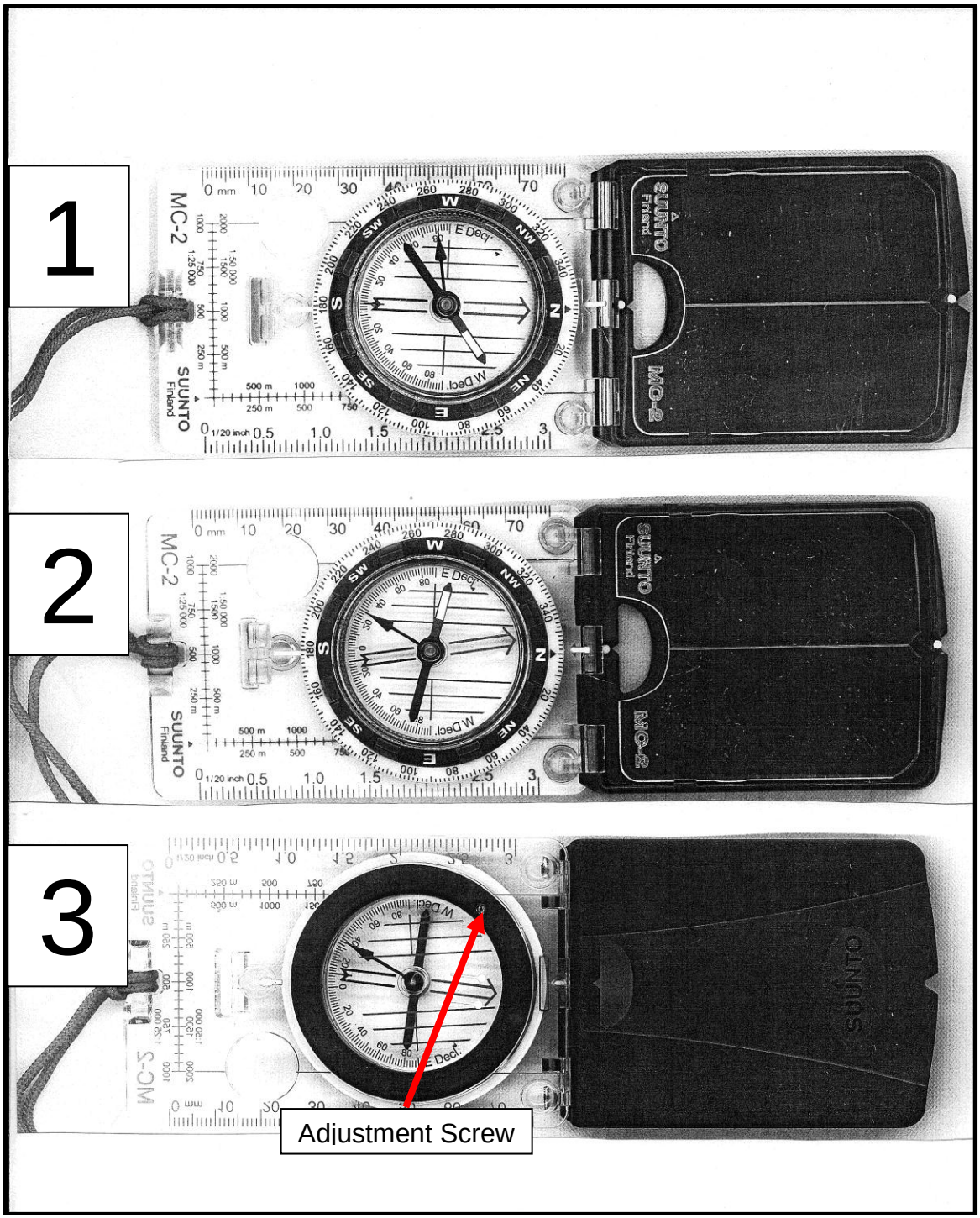

Figure 7-41 Adjusting Compass Declination

7.5.2.10 Posting the GMA

Command post has GMA info and will normally post it; if you don't know *ask.*

7.5.2.11 Orientating the Compass (Taking a Bearing)

- Hold the compass at eye level, at arm's length and keep the base plate flat. See ***Figure 7-42 Holding a Compass***.
- Using your dominant eye, aim the *Vee Sight (top of mirror)* at a distant object. See ***Figure 7-43 Aiming the Compass***.
- Tilt the sighting mirror in order to view the compass dial from above. See ***Figure 7-43 Aiming the Compass Part 1***.
- Line up the black sighting line (on mirror) with the two markers located at the top and bottom of the compass base plate. See ***Figure 7-44 Aiming the Compass Part 2***.
- Turn the dial until the red orientating arrow is centered beneath the red end of the magnetic needle. The catch phrase is "put red to bed". See ***Figure 7-45 Compass Orientating Arrow***.
- Read the bearing at the index marker.

Figure 7-42 Holding a Compass

Figure 7-43 Aiming the Compass Part 1

Figure 7-44 Aiming the Compass Part 2

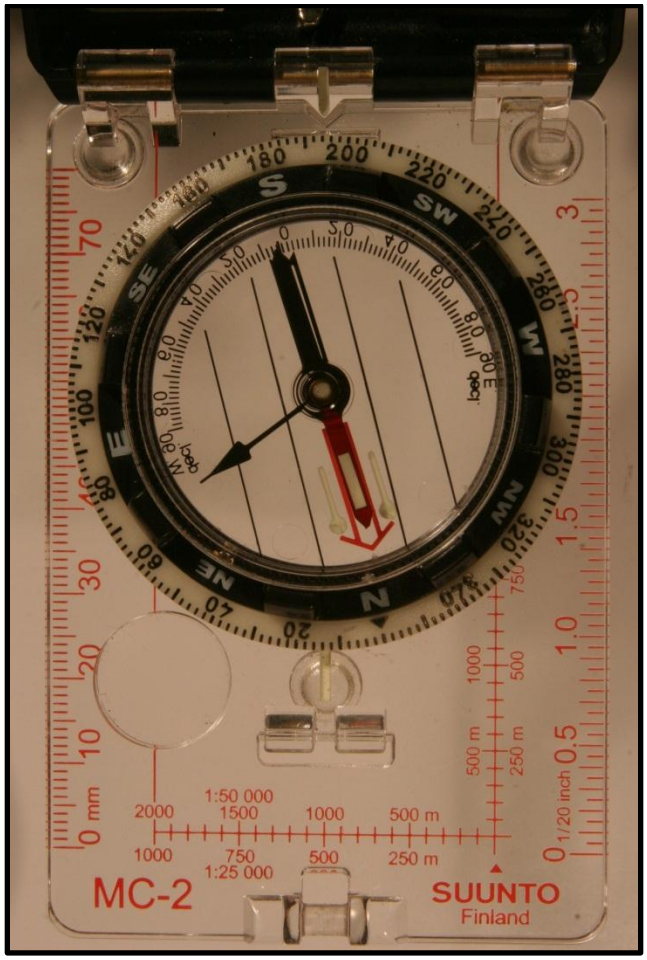

Figure 7-45 Compass Orientating Arrow

7.5.2.12 Orientating the Compass (Following a given Bearing)

- Rotate the compass dial until your given bearing is aligned with the index marker at the top of the compass.
- Turn your body until the red orientating arrow centered under the red end of the magnetic needle.
- Bring the compass to eye level, adjust the mirror to see the compass dial clearly, align the sighting line with the markers and keep the compass base level.
- By sighting with dominant eye only, continue to turn your body until the red orientating arrow is properly centered under the red end of the magnetic arrow. The catch phrase is “put red to bed”. See ***Figure 7-45 Compass Orientating Arrow***.
- Using your sighting eye only, look up and through the *vee sight* and find an object at the bearing you have been given.
- If you cannot see the distant object, select a smaller or closer target.
- If no object is in view you may have to send someone out to act as a target. See ***Figure 7-46 Bearing Target***.

Figure 7-46 Bearing Target

What affects the compass readings?

- Air bubble in compass chamber.
- Compass not held level – needle rubbing.
- Dust or dirt interfering with dial movement.
- Movement in compass dial – poor seal.
- Mineralization – affecting magnetic field.
- Metal objects – affecting magnetic needle
    - Pens, watches, automobiles, poles, tags and tabs.

7.5.2.13 Navigating Around an Obstruction

On occasion travelling direct from A to B may not be possible due to any number of obstructions or terrain difficulties. When the need arises to *go around* some obstruction, plan an alternative in a geometric way. Make turns at 090º (right or left) as required, keep track of the pace count and you will eventually get back on track. See ***Figure 7-47 Navigating Obstructions***.

Circumvention turns:

- Right turn – add 090º to present course.
- Left turn - subtract 090º from present course.

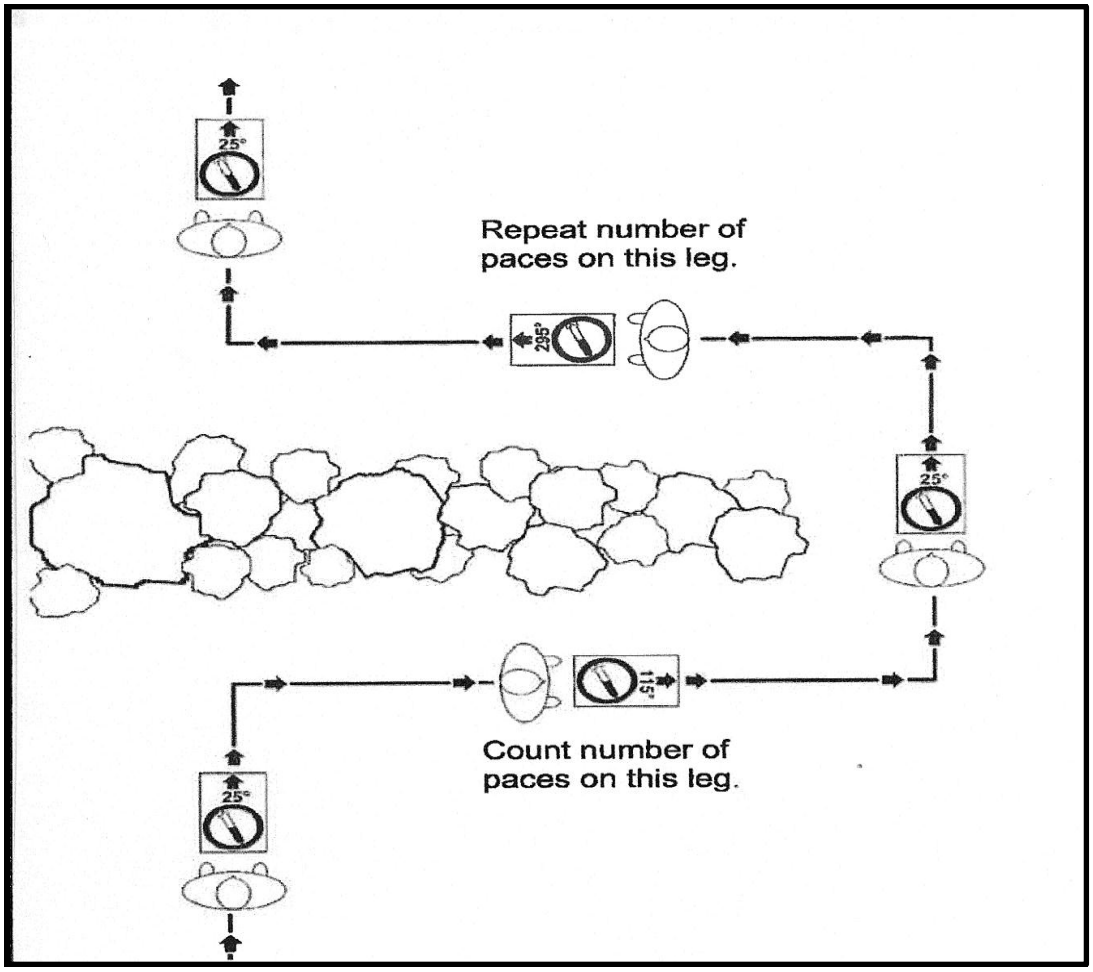

Figure 7-47 Navigating Obstructions

In ***Figure 7-47 Navigating Obstructions***:

- Original bearing turn right (025º + 090º = 115º).
- Then turn left back to 025º.
- Then turn left (025º - 090º = 295º).
- Then turn right (295º + 090º = 025º).

7.5.2.14 Reciprocals

A reciprocal is a return bearing (you walked north and returned south). Numeric expression of the same task walk is 000º or 360º out and 180º back. So you either add or subtract 180º, depending on the original number. The graduations on the compass bezel will serve as a quick ready reference. An example; if you had been on a course of 340º, the compass is dialed to 340º. If you look to the bottom of the bezel you will notice a luminous line adjacent to the reciprocal, in this case 160º.

7.5.2.15 Magnetic Anomalies and Influence of Electronics or Ferrous Metals

Occasionally searching takes us into areas which have some known magnetic anomaly. These are sometimes noted on maps. On other occasions, local knowledge is the only source of this information. If such conditions exist, searchers should be aware of them and consider alternatives such as GPS. Whenever the question arises regarding the validity of a compass, a few tips can help sort this situation out:

- Compare with another compass.
- Move to a different location.
- Compare your course movement (compass) to a GPS.

Searchers must also be wary when around anything electronic or containing ferrous metals. Small unnoticed objects can have an effect (i.e. wrist watches, zippers, rings, eye glasses, etc.).

7.5.2.16 Night navigation

Many compasses have several luminescent points. During night navigation, these must be recharged with a light source. Caution should be exercised so as to not compromise searcher's night vision. Common practice at night is to hold the compass at waist level and view it more often to ensure you stay on course. The practice of picking a target in the distance (as we do in daylight) is not an option at night.

Suggested team protocol:

- Habitually check compass for damage/malfunction prior to use.
- Post GMA at command post for all SAR operations and training exercise.
- Use permanent adjustment method for GMA exclusively.

Best practices:

- Encourage/recommend a team compass *brand.*
- Regular practice and training builds confidence and accuracy.
- Use of GPS as a complimentary component of the tool kit.
- Team members keep a log book, documenting tasking's (practical & exercise) including details (assigned course and distance, GMA, intended target coordinates and actual coordinates achieved, calculated error if any and elapsed time).
- Post GMA at command post.
- Check accuracy in a known environment.

Problems:

- Local magnetic anomalies.
- Local terrain – no substantial landmarks.
- Establishing distance travelled (tally system marginally successful).
- Overcoming the "*my compass was out*" syndrome.
- Fundamental errors in setting compass course or declination (GMA).
- Fundamental errors in use - not rotating the body.
- GPS course settings (true, magnetic, grid) - if not set correctly will potentially introduce lack of confidence in the compass.

Practical Exercise 1

Elementary exercises in an open area with common start point and known targets (i.e. light poles, antennas etc.). Document and compare compass to compass.

Set up an area for *measureable* outcomes (i.e. find 2 parallel roads approx. 1 km apart, with hydro poles along each. The pole locations can be input into the GPS and multiple tasking's can be assigned. Document entry and exit points. Some simple math will allow the calculation of error if any).
Use GPS to determine off course (compass navigation) error (ref the map) and make corrections.
Compare compass course to GPS *go to* function.

Practical Exercise 2

This exercise allows searchers to practice their compassing, GPS, tally/pacing skills and search techniques.

Scenario - A searcher has been called out on an evidence search. He marked the location of the command post on his GPS and proceeded into the bush, where he eventually located a clue. He entered its location on his GPS, marked it with flagging tape and then proceeded to search for more clues. He became tired, so he sat down and had something to eat. He used his GPS and its *GOTO* feature to get a bearing and distance back to the command post and proceeded to head back using his compass for navigation. When he got back to the command post, he discovered that he had inadvertently left his GPS at the spot where he had taken his break. He remembered the bearing and distance back to the command post that he had taken at his resting spot.

Assignment - Locate the GPS and then use the GPS to locate and retrieve the clue.

Set-up - You will need some item to act as the evidence or clue, such as a knife or a coffee cup and an extra GPS unit. With the GPS, mark the location of the starting point. Walk into the bush and plant the clue. We suggest going at least 150m before dropping the clue. Mark its location on the GPS and record the waypoint number or name. Proceed in another direction, as if you are searching for more clues. It is suggested that you go at least 75m. Find a spot that would be suitable for someone to sit down for a break, such as a fallen tree or a rock. Use the GPS to get a bearing and heading back

to the starting point, from that location. Drop the GPS and return to the starting point. It would be wise to take another GPS into the bush with you and mark the locations of the points so you can find them in case the searchers cannot.

This exercise takes about 15 minutes to set up and should take the searchers 30 to 60 minutes to complete, depending on the distance they have to travel, the thickness of the bush and the deviousness of the hides.

7.5.3 Tally System

OBJECTIVE: Establishing distance travelled over the ground is a fundamental requirement for accurate land navigation in particular for SAR work. It is imperative that searchers be able to accurately travel a distance over ground and document it. This documentation is helpful and often times essential for determining and reporting your ETA, status report or debrief at the CP.

There are however modern devices such as GPS, hip chains, pedometers etc. which may in fact be more accurate but are prone to failure due to low batteries, depletion of expendables (line in hip chain) etc. With the potential for failure of such devices it is necessary for searchers to practice and perfect the tally walk procedures. We must appreciate that the tally system is not an absolute nor precise method of documenting distance travelled but rather an approximation.

7.5.3.1 Pace

In the normal course of walking, each step you take is approximately 0.75m (that is the distance between your right and left foot). If you begin with your right foot as your first step, then count 1 *pace* every time your left foot hits the ground after that, the distance (average) covered would be approximately 1.5m or *1 pace.* In this example, every time your left foot hits the ground, count 1 pace.

Figure 7-48 Pace Count

7.5.3.2 Tally

If each average pace is 1.5m then it would take the average person about 65 paces to travel 100m or *1 tally*. So by definition, *1 tally* equals 100m and it would take 10 *tallies* to travel 1 km (1000m).

It is important to note that every searcher must, by experimentation, determine their own unique pacing values and come to know how many paces they must take to travel 100m or *1 tally*. This should be done in varying types of terrain to define any variations in pace/tally count. It is also a good practice to note the time it takes to travel these distances for future reference.

7.5.3.3 Keeping Track

Various methods have been devised to assist searchers in keeping track or count of tallies travelled. These include but are not limited to:

- Note taking
- Tally cord
- Tally clicker
- Digital tally counter
- Coins / pebbles from one pocket to another

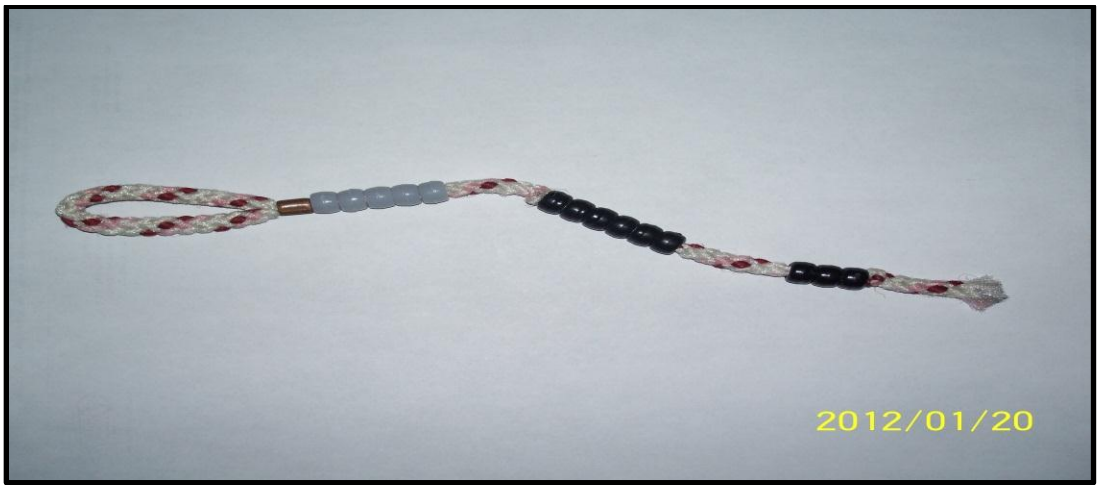

Figure 7-49 Tally Cord

Figure 7-50 Tally Clicker

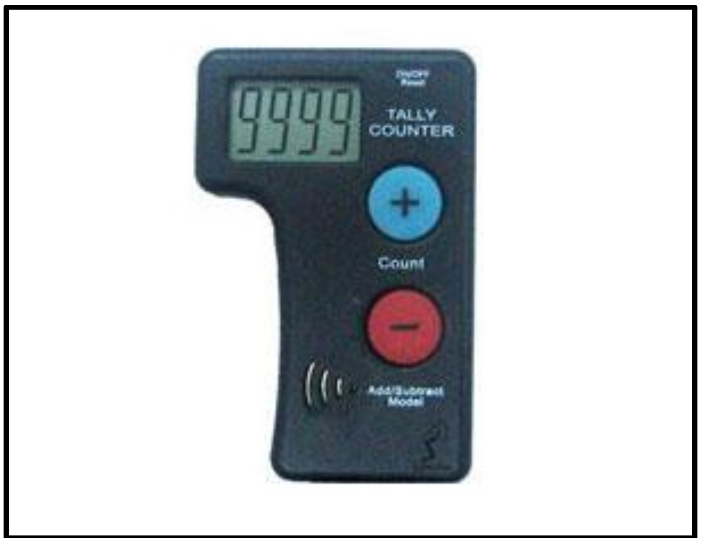

Figure 7-51 Digital Tally Counter

NOTE

If you lose count – restart count at 30 and your error will be limited to approx. a ½ tally.

Reporting your position to the command post would include the following, “From my assigned start point I have travelled eight tallies on the assigned bearing of 070º”.

7.5.3.4 Map and Tally System

Maps commonly used for ground SAR are National Topographic System (NTS) maps at 1:50,000 scale and have a grid overlaid on them, forming small boxes (2cm x 2cm). The width and height of each box is 1km or 1000m. You can visually subdivide these boxes into equal units for reference purposes. If you have marked your start position, you can then, knowing your direction of travel and number of tallies traveled, plot your new position.

Procedures (thing to remember)

- Appreciate the need for measuring distance travelled on the ground.
- Interpret the metric system of measurement 1000m = 1km.
- Recognize the parallels to a 1km grid on a 1:50 k topo map.
- Define the tally in SAR - 1 tally = 100m and 10 tallies = 1km
- Relate to the average human pace (2 steps) equals approx. 1.5m.
- Apply the math to determine the average of 65 paces = 1 tally (100m).
- Establish methods of recording tallies covered – tally cord etc.
- Conduct field trials in various terrains to establish personal paces count per tally.
- Record for future reference time taken to transit 1 tally in various conditions.
- Recognize that the number of paces per tally differs with each person.
- Practice a routine - *a pace every time your **left** foot hits the ground.*
- Establish a standard practice if you lose count – restart count at 30 and your error will be limited to approx. a ½ tally.

- Investigate alternatives such as GPS, hip chains, pedometers.

Suggested team protocols
- Include *tally cord* as part of standard SAR kit.
- Commonly refer to distance as tallies.
- Duplicate the effort - record tallies, backed up with technology (GPS).
- Do not let tally *obsession* distract searcher from other important tasks, in particular *looking for clues.*
- Tally walks are a *use it or lose* it procedure.

Practical Exercise
- Set up a training site along a road with moderate bush parallel to the road.
- Measure off an exact distance (min 500m).
- Walk one direction on the roadway - record number of paces and amount of and time taken.
- Return in moderate bush - record number of paces and amount of time taken.
- Do the math to establish personal paces per tally for each walk.
- Repeat the above exercise in varying terrain as available.

7.5.4 Global Positioning System (GPS)

OBJECTIVE: With the advent of Global Positioning System Technology, the accuracy with which searchers can complete and document a search assignment has substantially improved.

While the GPS is a reliable and universally available system, there are factors beyond our control that may cause it to be less effective or not available at all. We must, as searchers, regard GPS as an *aid to navigation* and not rely on it totally for navigation and documentation purposes.

As with all technological devices, there is a learning curve involved and searchers are encouraged to become familiar with the team GPS, in particular, as to standard settings, menus, pages, etc. A *comfort level* must be developed such that searchers are capable and confident in the use of these devices.

GPS - A space based triangulation system, using satellites and computers to measure (calculate) positions anywhere on or above the earth. Coordinated positions are expressed as
- Latitude and Longitude
- Universal Transverse Mercator (UTM) grid
- Military Grid Reference System (MGRS) utilized by SAR teams.

The complete system is known as the Navigation Satellite Timing And Range (NAVSTAR) system. NAVSTAR was:
- USA government built at a cost of 12 billion dollars.
- Project began 1974 and was completed 1993.

3 Segments

- 1. *Space* - 28 Satellites including spares
- 2. *User* - GPS receiver
- 3. *Control* - satellite operations centre Colorado

7.5.4.1 Ground Control Segment

These stations monitor the GPS satellites, checking both their operational health and their exact position in space. The master ground station transmits corrections for the satellite's ephemeris constants and clock offsets back to the satellites themselves. The satellites can then incorporate these updates in the signals they send to GPS receivers. There are five monitor stations:

- Hawaii
- Ascension Island
- Diego Garcia
- Kwajalein
- Colorado Springs (Main Control Centre)

Satellite Orbit

- Once every 12 hours
- 11,000 miles above earth

What's the signal? - GPS satellites transmit two low power radio signals, designated L1 and L2. Civilian GPS uses the L1 frequency of 1575.42 MHz in the UHF band. The signals travel by line of sight, meaning they will pass through clouds, glass and plastic but will not go through most solid objects such as buildings and mountains.

A GPS signal contains three different bits of information:

- Pseudorandom code
- Ephemeris data
- Almanac data

Pseudorandom code is simply an I.D. code that identifies which satellite is transmitting information. You can view this number on your GPS unit's satellite page, as it identifies which satellites it's receiving.

Ephemeris data, which is constantly transmitted by each satellite, contains important information about the status of the satellite (healthy or unhealthy), current date and time. This part of the signal is essential for determining a position.

Almanac data tells the GPS receiver where each GPS satellite should be at any time throughout the day. Each satellite transmits almanac data showing the orbital information for that satellite and for every other satellite in the system

7.5.4.2 Time Difference Calculations

The position of satellites is always known by the system and transmitted to the GPS receivers in a packet of information called an *almanac*. Another packet of information continuously transmitted is the *ephemeris* including satellite Identification (ID), health and current date and time. GPS receivers use the data received to calculate the position of the GPS on or above the earth.

7.5.4.3 How it Works

Radio waves are electromagnetic energy and travel at a fixed speed of 186,000 miles per second. A GPS can then determine the distance it is from the satellite using fundamental *time, speed, and distance calculations*.

Compare this to your vehicle travelling at 60km/hr and ask how far will you have travelled in 1 hour or in 1 minute or in 1 second? A little math would give you the answers. If the GPS (on earth) does this for 4 satellites it uses trilateration and triangulation to calculate its position and expresses it as a coordinate position on earth.

Super accurate atomic clocks on board the satellites help accomplish a high level of accuracy. As an example, times are expressed to 7 decimal places of a second and if a satellite were at 11,000 miles altitude it would take .0591397 seconds for its transmitted radio signal to reach earth.

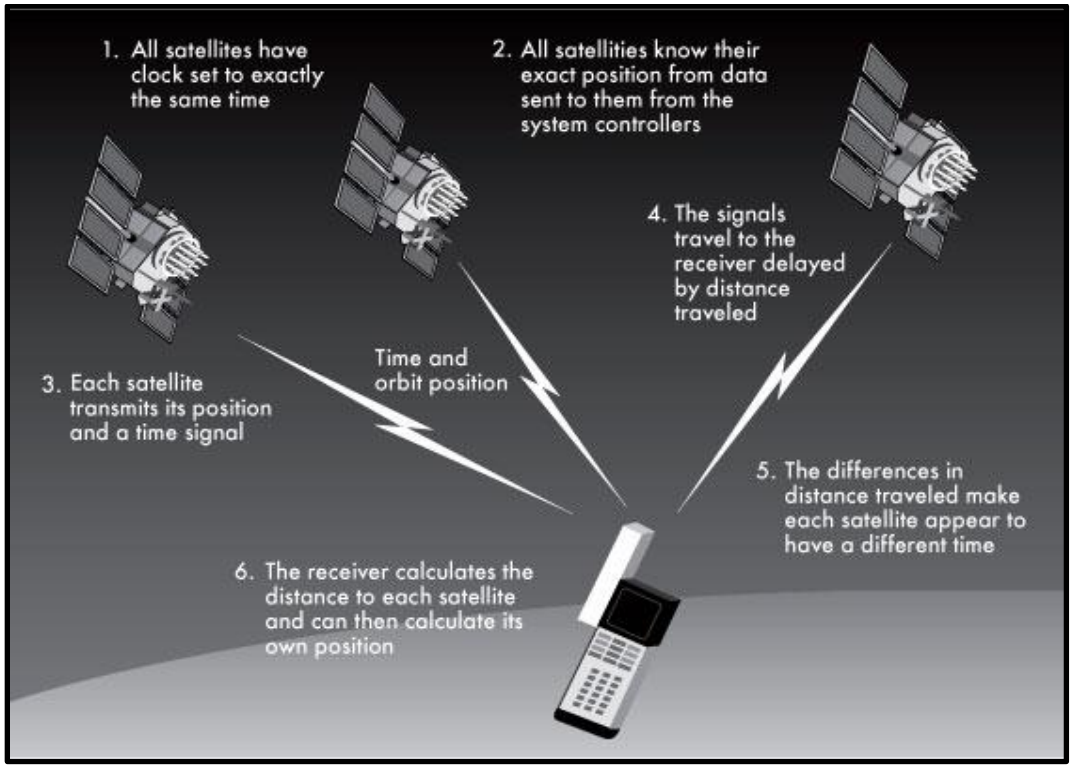
1. All satellites have clock set to exactly the same time
2. All satellities know their exact position from data sent to them from the system controllers
3. Each satellite transmits its position and a time signal
Time and orbit position
4. The signals travel to the receiver delayed by distance traveled
5. The differences in distance traveled make each satellite appear to have a different time
6. The receiver calculates the distance to each satellite and can then calculate its own position

Figure 7-52 GPS Calculations

7.5.4.4 Satellite Radio Frequency Transmissions

Data transmitted from satellite antennas is transmitted in all directions (Omni directional) and could be pictured as an ever increasing sphere or ball of energy as it travels through space towards earth to the waiting GPS receiver.

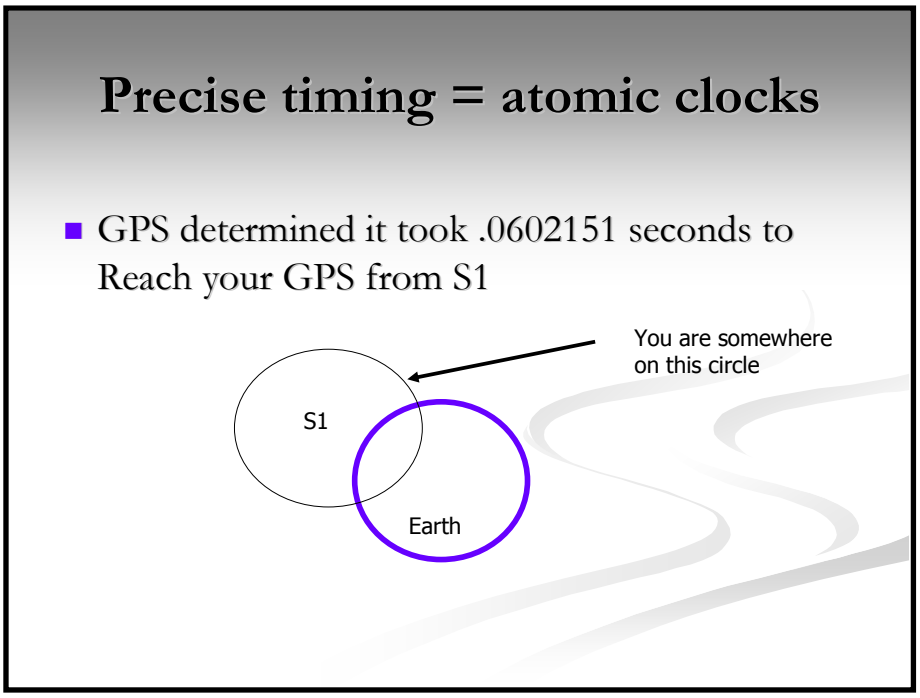
Precise timing = atomic clocks
GPS determined it took .0602151 seconds to Reach your GPS from S1
You are somewhere on this circle
S1
Earth

Figure 7-53 GPS Atomic Clock

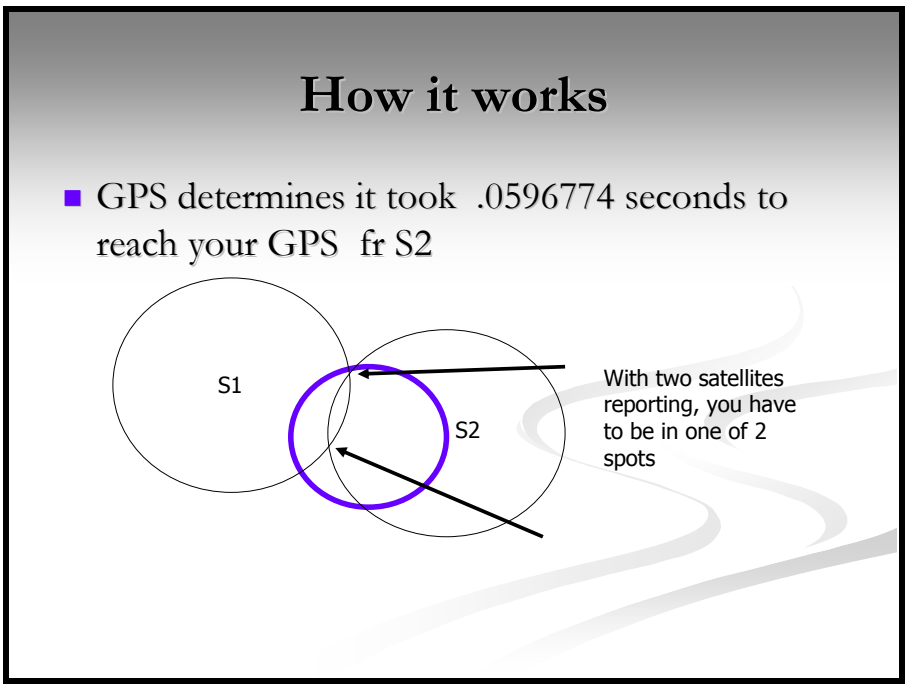
How it works
GPS determines it took .0596774 seconds to reach your GPS fr S2
S1
S2
With two satellites reporting, you have to be in one of 2 spots

Figure 7-54 GPS How It Works

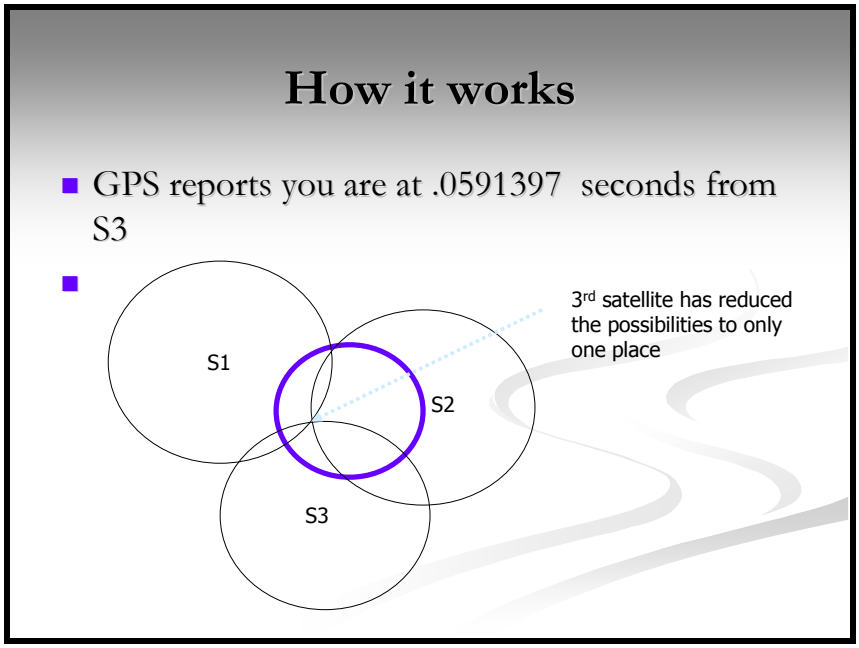
How it works
GPS reports you are at .0591397 seconds from S3
3rd satellite has reduced the possibilities to only one place
S1
S2
S3

Figure 7-55 GPS How It Works

7.5.4.5 Accuracy

The worst case scenario will result in an accuracy of ± 100m and best case is about 5m. An Estimated Position Error (EPE) or *Accuracy* field will appear in a data field on the GPS indicating current accuracy.

GPS receivers need a clear unobstructed view of the satellites. We must recognize that if this view is compromised by circumstances such as being inside buildings, under dense tree canopy, beside tall buildings or cliffs or inside vehicles; that the GPS system may not work effectively.

NOTE

GPS receivers typically present a page of data or an information alert that assists the operator in recognizing when *poor satellite coverage* is being experienced. It is important that searchers recognize this and take the time to verify good satellite coverage exists before reporting or recording their current position. A GPS placed out of view of the satellites but still turned on, will continue to display its last good fix as position and searchers in haste may erroneously report this as their position.

Regarding accuracy, typical icons or text may indicate:

- 2D = 3 satellite signals acquired – no elevation data will be available
- 3D = 4 or more satellite signals acquired – elevation data available
- Wide Area Augmentation System (WAAS) - corrections automatically applied for local inaccuracies.

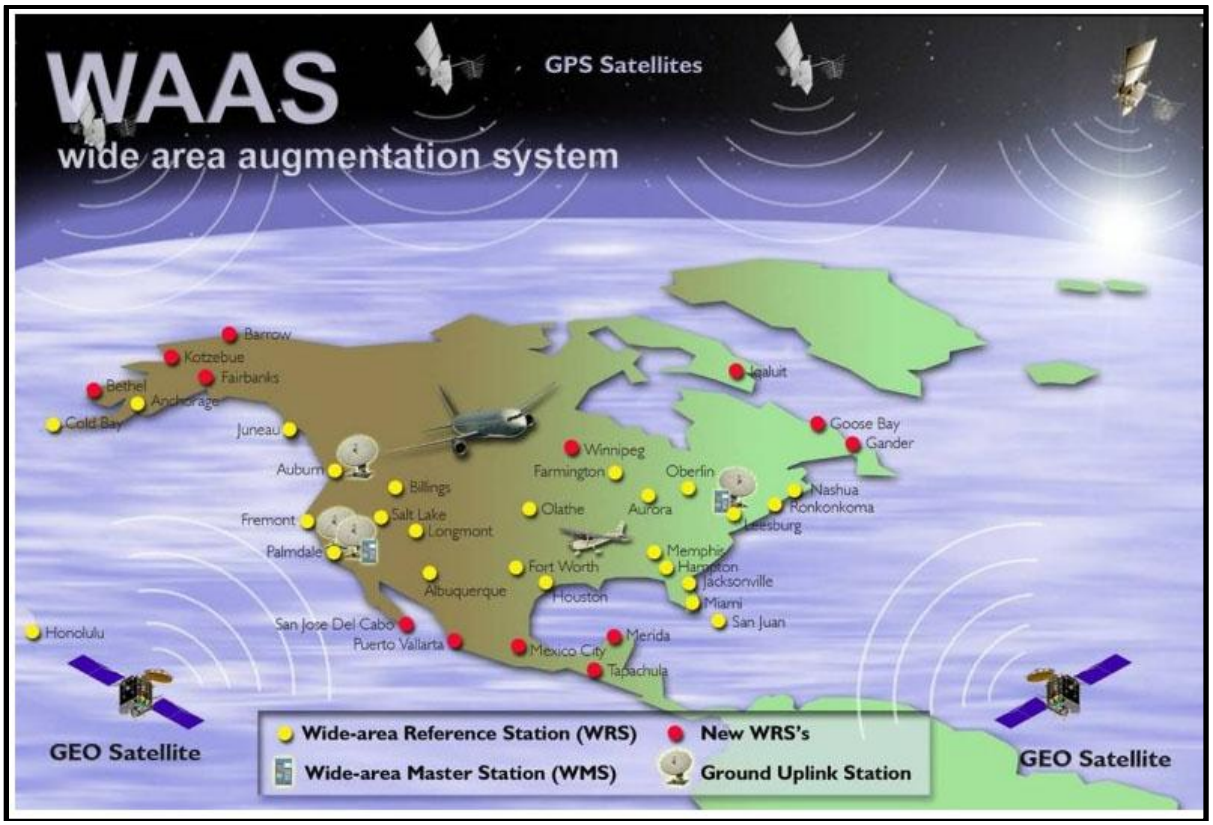

Figure 7-56 Wide Area Augmentation System

NOTE

As WAAS is designed for aviation use in the United States, its ground performance in Canada and elsewhere is limited by certain factors. The position of the geostationary satellites over the equator is problematic in Canada as this limits their reception in the higher latitudes. The original WAAS satellites were visible only by a few degrees above the horizon where topography and vegetation can easily block the signal reception.

Another factor is the distance from the ground reference stations which collect the data used to generate the corrections transmitted by the WAAS satellites.

As a general rule, if your receiver cannot see satellites 48 or 51, and/or you are more than 200 nautical miles from a reporting station, turn off the WAAS function on your GPS and this will save battery power.

Portable GPS receivers require batteries to operate. Monitoring battery status is an important requirement for searchers. A battery status icon is typically displayed on screen and users must become aware of it and monitor it routinely (see ***Figure 7-57 GPS Information Page***). All searchers must carry spare batteries.

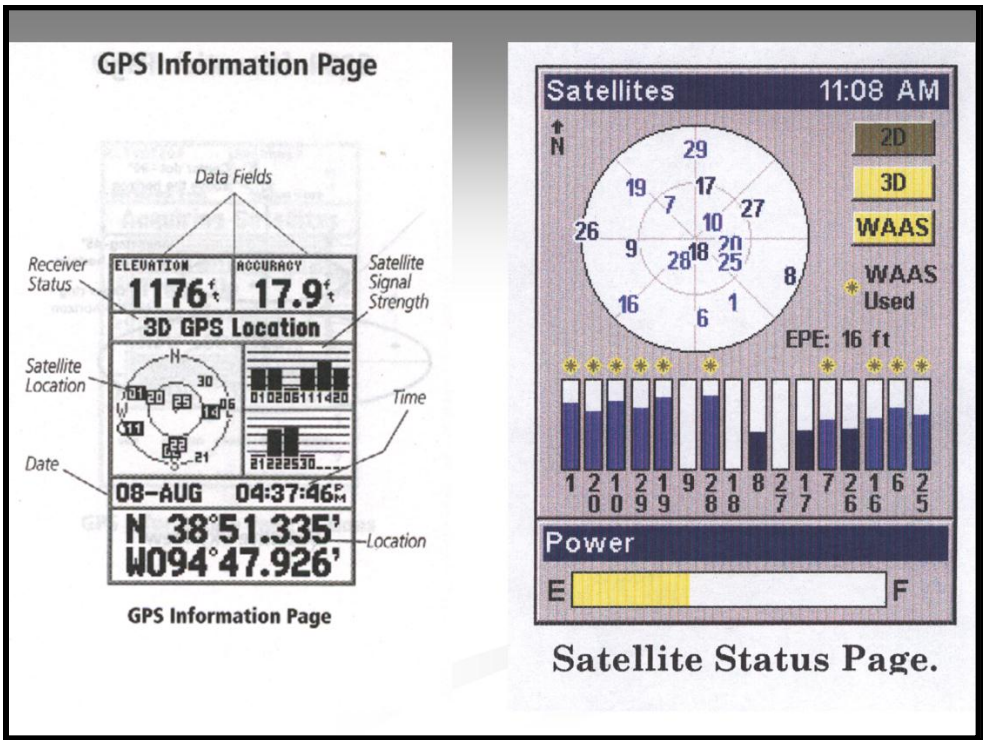

Figure 7-57 GPS Information Page

7.5.4.6 Setup and Configuration

All GPS receivers require a degree of user setup and configuration. A typical setup for ground SAR applications is as follows:

- Coordinate display should be set to MGRS.
- Datum should be set to the same datum as command post operations map – North American Datum 83 (NAD 83) or North American Datum 27 (NAD 27) (if unknown set to World Geodetic System 84 (WGS84)).
- Track acquisition should be on and set to *fill*.

NOTE

All old tracks must be deleted prior to be deployed on tasking.

- Old waypoints should be cleared and a new first waypoint inserted for command post location.
- North reference should be set to grid (bearings taken from a map or given from command post are referenced to grid north).
- Distance display set to km (metric).
- Turn WAAS on (if available on GPS).

7.5.4.7 Coordinate Positions

A fundamental function of any GPS is to display in a digital format, the current coordinate position of the GPS. Historically it was displayed as *latitude* followed by *longitude*.

The aeronautical and marine world has maintained this method. With the development of accurate topographic maps for ground based navigation, a numeric grid system has been developed. This is functionally not unlike a city map grid where you are shown, in a key that a particular street is in a block labeled B – 6 as an example. The system in use on topographic maps has its origin in what is referred to as the Universal Transverse Mercator (UTM) grid system; in SAR we have adopted a variance of that called Military Grid Reference System or MGRS. On a 1:50,000 topographic map, this grid appears as 2cm x 2cm boxes super-imposed over the map. The lines that form these boxes extend to the perimeter of the map and are numbered. These numbers are the key to determining which *box* you are in. In the following example the first two numbers in each numbered group are 94 and 78. The first is an *Easting* number found at the top or bottom of the map and the second is a *Northing* number found at the left or right side of the map. The additional following numbers in each group will let you fine tune the position in the box to an accuracy of one meter for full UTM.

7.5.4.8 Typical MGRS coordinate display

Typical MGRS displayed on the GPS would be:

- **16T FS 94345 78412**

To interpret this we must analyze the components of this grid reference (this example is from map number 41K9 with a 1:50,000 scale).

- **16** is the Zone Number. There are 60 zones around the world numbering from west to east and they increase 6 degrees per zone in an easterly direction. (Zone 16 includes from 090º west longitude to 084º west longitude. Zone 17 would cover from 084º longitude to 078º longitude and so on).
- **T** is an alpha designator for a north/south boundary and in this case is a segment from 40º north latitude to 48º north latitude (changes at 8º increments northbound).
- **FS** is a 100,000m designator. See ***Figure 7-58 Zone Designation***.
    - All 1:50,000 topographic maps have a graphic in the lower right corner which indicates the Grid Zone Designation and 100,000m square identification.
    - Note the zone in this display is16T. If you are travelling east or west, you may leave a zone (example leaving zone 16 and enter zone 17). If travelling north or south, the alpha designator may change (example travelling south bound from area T and entering area S).
    - If these changes occur, report the complete MGRS grid reference when making position reports. You should routinely report and save a waypoint with command post so you can refer back to its waypoint data to see if you have entered a new zone.

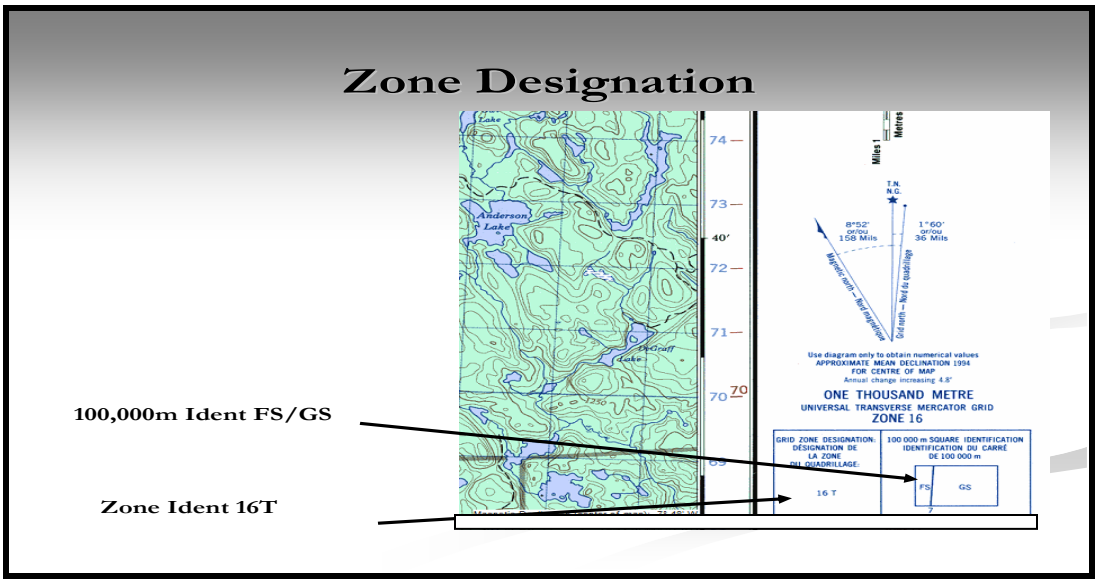

Figure 7-58 Zone Designation

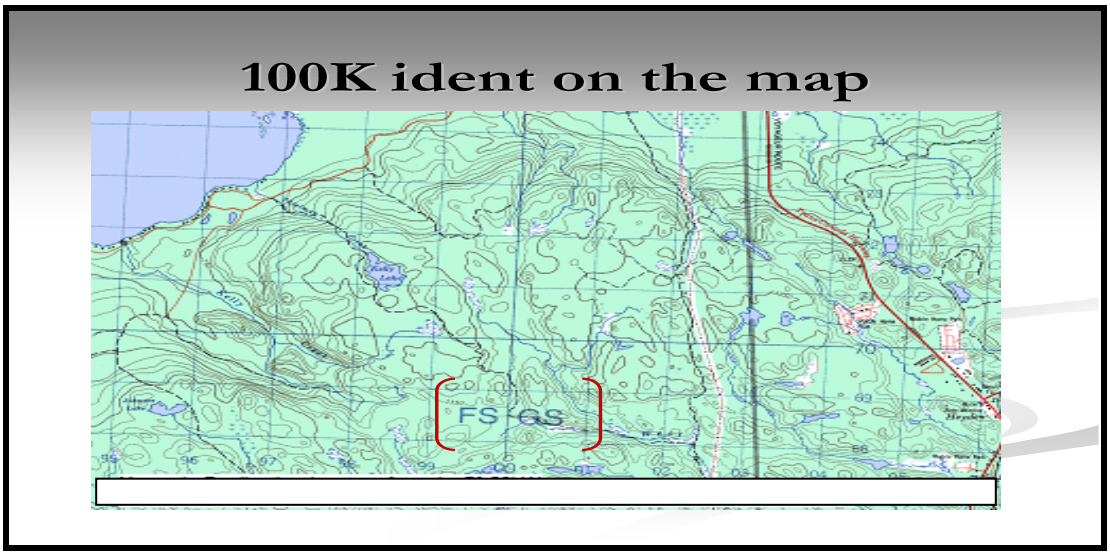

Figure 7-59 100,000m Designator

NOTE

If you travel from west to east on this map, the display on your GPS will switch from displaying **16T FS to 16T GS**.

- **94345** is an *Easting* reference (first set of numbers). To locate this on the map, find the easting line numbered 94 (top or bottom of map) and this position is 345m east of this line.
- **78412** is a *Northing* reference (second set of numbers). To locate this on the map, find the northing line numbered 78 (left or right side of the map) and this position is 412m north of this line.
- Where these two Lines of Position (LOP) intersect, would be the coordinate position.

NOTE

It is important when doing this that the GPS be set to the same datum as the map in use, typically NAD 27, NAD83 or WGS 84.

7.5.4.9 Reporting Position to Command Post

Initial reporting of a position should include the full MGRS GPS coordinate displayed (example - **16T FS 94345 78412**). Subsequent reports can be simplified and shortened by dropping the identifiers and the last digit of the numeric display resulting in 10m accuracy (example - **9434 7841**).

NOTE

You are not reporting the last digit, so if plotting this 8 digit position on a map, you will be trying to plot a position to the nearest 10 meters.

If any uncertainty develops, revert to full MGRS display.

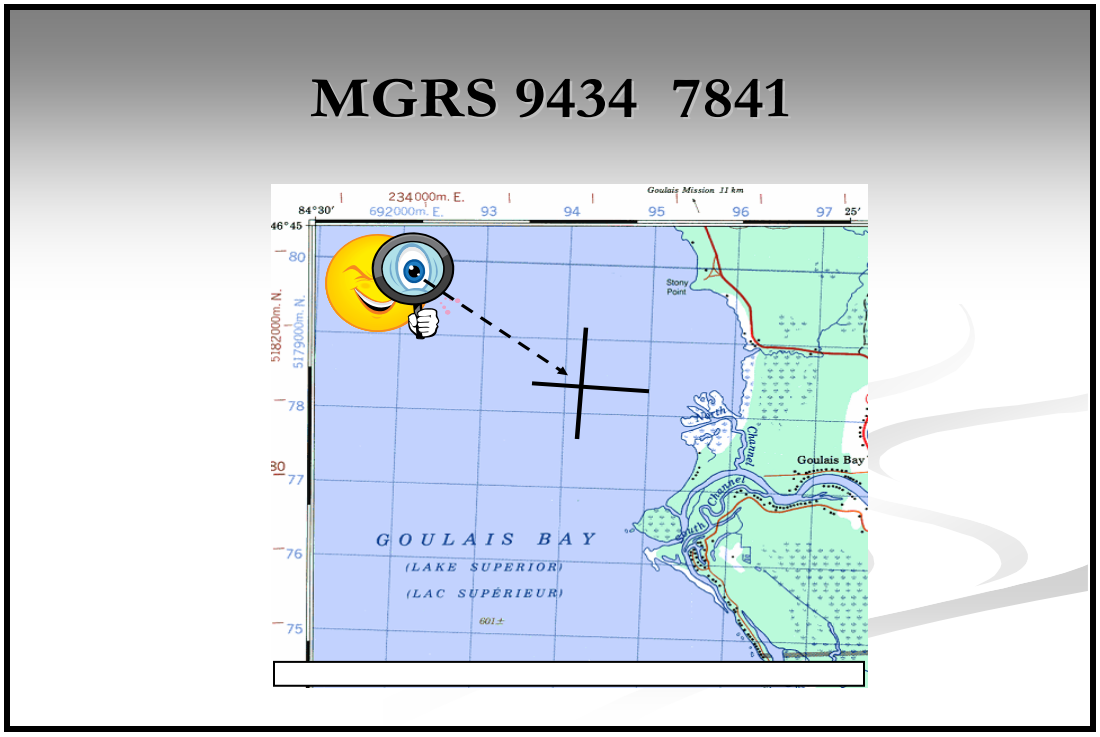

Figure 7-60 MGRS on A Map

7.5.4.10 Eyeball to 100m Accuracy

Focus on the first 3 numbers in each group, and then find the intersection of 94 and 78. This is the SW corner of the box you are in. Then visually subdivide the box into 10 units *easting* and 10 units *northing;* you are 3/10 further east and 4/10 further north. Each tenth equals 100m. First set of digits are *eastings* and increase as you move east. Second set of digits are *northings* and increase as we move north. To plot to 10m accuracy using the last digit, you need to utilize a roamer. For more information on roamers, see Section ***7.5.1 Map***.

7.5.4.11 Additional GPS Functions Useful in SAR:

- Saving the current position as a *waypoint* (example command post location or location of a clue. GPS will assign a number or user can name the waypoint).
- Entering coordinates for a destination waypoint.
- Determining range and bearing to destination – a *go to* function.
- Planning complex routes to destination waypoints.
- Recording track data showing where searchers have searched (see ***Figure 7-64 GPS SAR Track Download***).
- Determining times for sunrise and sunset.
- Displaying topographical maps showing present position.
- Displaying current time.
- Determining estimated time to destination at current speed.

7.5.4.12 Tips on Saving Waypoints

Saving or inserting waypoints (sometimes called marks or points) is one of the more useful functions of a GPS during search and rescue missions. There are at least 4 ways this can be done:

- If you are at the location of the desired waypoint, pressing a single button commonly called *mark*, then accept or customize the name or number assigned to it followed by pressing a save button.
- If you have access to a computer with digital mapping, you can connect the GPS to the computer and download single or multiple waypoints.
- If another searcher or the command post has given you the coordinates, you may key them in.

NOTE

The complete MGRS reference is required which includes zone number, 100k identifier and 5 digit easting and 5 digit northing.

- If you are looking at a 1:50,000 topo map, you can quickly eyeball the coordinate to 100m accuracy. The zone number and 100k identifiers are printed in a graphic typically the bottom right corner of the map. Again you are required to key in 5 digit easting and 5 digit northing. In this example the last two numbers in each group can be zeros because you are estimating your position to only 100m accuracy (example **16T FS 94300 78400)**.

Protocol:

- For each tasking, clear GPS of previous tracks and waypoints.
- Routinely save a waypoint for command post location.
- Save a waypoint at other key locations.
- Offer your GPS to command post if they require track data (see ***Figure 7-64 GPS SAR Track Download***).
- Carry spare batteries & data cable.

Best practices:

- Good note taking and documentation improves confidence. Keep duplicate records, one in the GPS and also record in notebook.
- Include GPS use in training scenarios wherever possible.

Problems:

- Total reliance on GPS with exclusion of basic map and compass skills.
- Lack of discipline in confirming coordinate position shown is current.
- Many GPS handhelds have a Man Over Board (MOB) hot button. Know how to recognize and clear if necessary.
- Failure to keep GPS in view of satellites resulting in sporadic track detail or inaccurate positional data.

Figure 7-61 Typical GPS Compass Page

Figure 7-62 Typical GPS Map Page

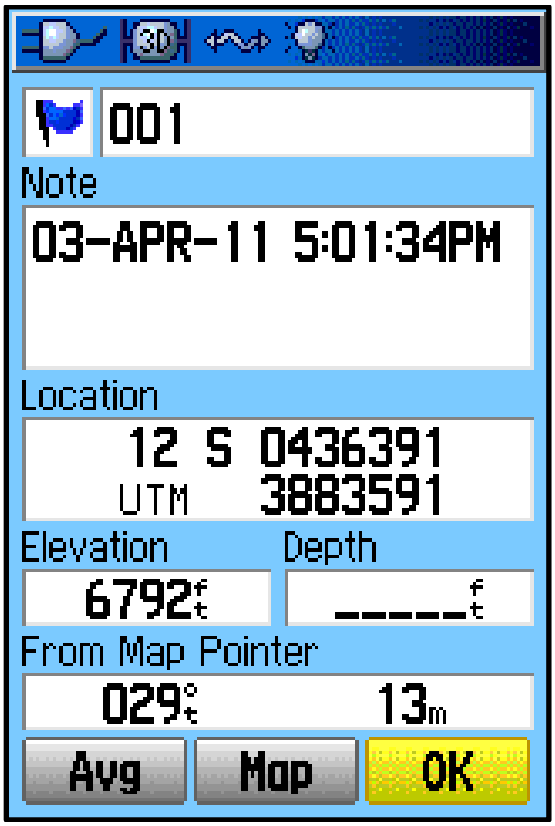

Figure 7-63Typical GPS Waypoint Page

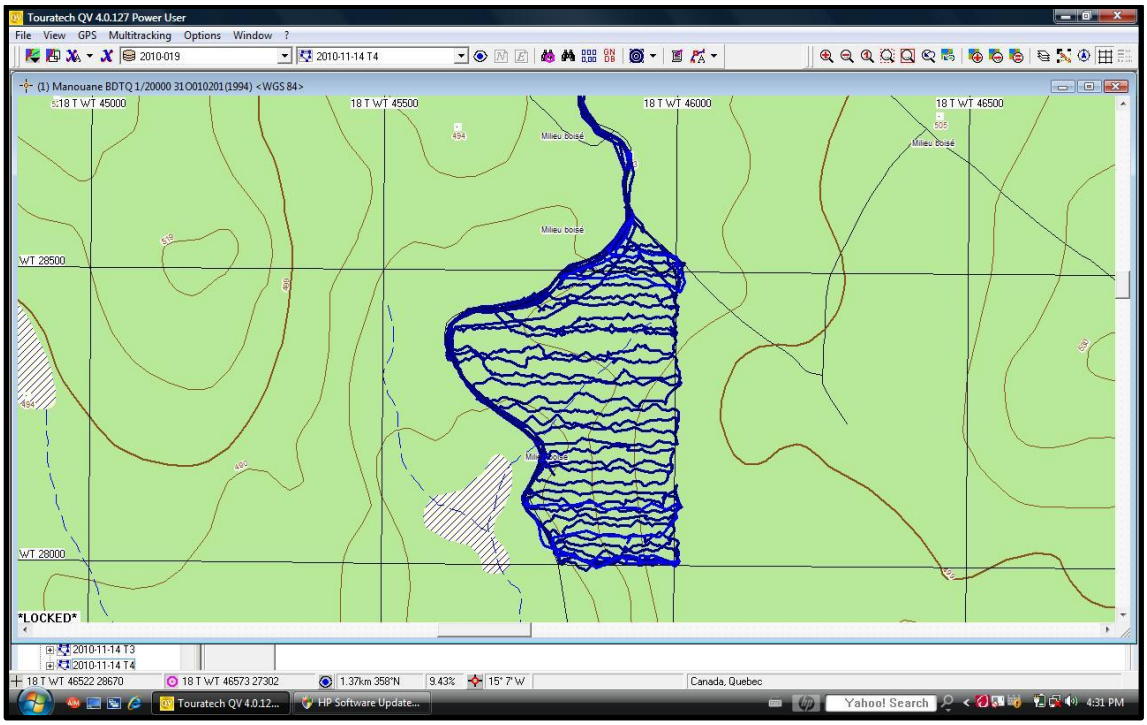

Figure 7-64 GPS SAR Track Download

Practical Field Exercise

Practice exercises should be designed to include typical GPS tasks expected during actual SAR missions. Should include:

- Basic setup.
- Acquire, download and clearing tracks.
- Acquire, name, download and clear waypoints.
- Navigation with the *go to* function.
- Reporting position to command post.

NOTE

There are numerous geo cache sites in existence which can be used for training purposes.

7.6 Legal Issues in Search and Rescue

OBJECTIVES: Understand that laws are open to interpretation in different areas, but the team will not support members who blatantly break the law.

Legal issues are not always clear cut or black and white; law tends to be open to interpretation within reason. Laws change or differ from province to province, or even jurisdiction to jurisdiction such as counties or towns. Laws can normally be associated with levels and penalties/rewards depending on the locality and affected components. Does the law come from the local, provincial or federal level? Is it a criminal or civil matter?

7.6.1 Civil Law

Civil law is the branch of law pertaining to suits outside of criminal practice. Trespassing is considered to be a wrongful interference with or disturbance of the possession or property, and is applied to personality as well as realty. Personality or personal property is movable things as distinguished from things attached to the realty. However, things attached to the realty may be considered personality if by their nature they are able to be severed without injury to the realty. Personality includes tangible items such as televisions or radios, and intangible property representing value such as stocks or bonds.

Realty - is an interest in land, another word for real property or real estate. This should be considered land and other property permanently affixed to it. Possession is considered to be the dominion and control over property.

Search teams do not often have problems in this area, but it should be touched upon. In prosecuting a mission, members often walk a fine line in legality. When you enter onto private property because you are looking for missing or lost person(s), you are breaking the law, but you most likely will not be brought up on any charges. This does not mean that you should charge into the situation though. Think, and be positive before you add any additional risks to the mission. Additionally, this is not normally the team's call to make, unless they are positive. The command post with approval from the law enforcement will give you permission to enter this property, and you will normally do this with assistance from local law enforcement officials.

Follow the guidance that comes down from the command post and/or local law enforcement, but minimize the possibilities of future investigations into your actions. As a search member you need to always remember to act professionally and within the legal boundaries already established so that you do not tarnish the team’s image or your own.

Negligence - is the failure to exercise that degree of care which a person of ordinary prudence (reasonable person) would exercise under the same circumstances. The term refers to conduct which falls below the standard established by law for the protection of others against unreasonable risk of harm. Negligence does not comprehend conduct with reckless disregard of the interests of others.

In discussing negligence, one needs to understand duty of care. In reference to negligence duty of care says that if an individual owes this duty to others that he/she must conduct himself/herself so as to avoid negligent injury to them.

While discussing negligence, due care should also be brought up. Due care is care that is reasonably commensurate with a known danger and the seriousness of the consequences which are liable to follow its omission. This may be ordinary care or a high degree of care, according to the circumstances of the particular situation.

To close off discussions of negligence, a *Good Samaritan* or good faith laws need to be mentioned. This refers to a total absence of any intention to seek an unfair advantage or to defraud another party; an honest and sincere intention to fulfill one's obligations. Thus if you perform at your expected standard of training with honest intentions, in most provinces you are covered. The problem is when you enter into the care without proper training for your rating for the situation. You may then be out of luck.

7.6.2 Criminal Law

In general, criminal law is concerned with acts done with malicious intent, from an evil nature, or with a wrongful disposition to harm or injure other persons or property. Violations of criminal law are considered to be acts against the community. Cases are thus noted as Prosecution vs. Defendant rather than Plaintiff vs. Defendant in civil cases.

Force - most criminal cases involve the use of force. Force in this case is defined as a physical act or the threat of physical acts intentionally used to do an act or to commit a crime. The most that a team can truly do is warn the individual of consequences of his/her actions and notify authorities.

Self-defense or preservation - in discussing force and the use of it, we should discuss what you can do to protect yourself. Every person has this right, within reason. Deadly force may only be used in defense of deadly force. The person using self-defense must be free from fault; provoking action either vocally or through actions undertaken, can cause a failure in the eyes of the law of the use of force. The person must exhaust options for escape either physically or through negotiation following the fight or flee rule. If you have a way out, you must use it. Don't stand in front of the person wanting to provoke an argument or a fist fight. Simply warn them of the consequences of their actions and let the law enforcement or police officer handle the situation.

7.7 Missing or Loss Person(s) Behaviors / Characteristics

OBJECTIVE: To make the searcher aware of the different characteristics and behaviors displayed by distinct groups of people.

7.7.1 Behaviors and Characteristics

By analyzing behaviors and characteristics exhibited by missing or lost person(s), then grouping these common trends into categories, it may be possible to *predict* the actions of a similar missing or lost person(s). Though it only indicates tendencies and probabilities, it is a tool to assist in indicating high probability locations.
This management tool deals in generalities and not absolutes. Through historical statistical studies, categories have been developed.

7.7.1.1 Children 1 to 6 years of age

- They are unaware that they are lost.
- They have no sense of direction, and little navigational skills.
- They wander with no fixed purpose.
- They may not respond to call or whistles.
- They can travel through dense or difficult areas.
- They tend to remain in the general area, finding suitable shelter.
- They are easily distracted by random events, (a frog hops nearby).

Potential places to search - Look under dense underbrush, overhanging rock, inside vehicles or appliances, buildings etc. They are difficult to detect and rarely will they walk out by themselves.

7.7.1.2 Children 3 to 6 years of age

- They are developing an understanding of being *lost.*
- They will try to return home and can end up wandering farther away.
- Their mobility is much more developed.
- They only perceive *going* and don't plan on the return phase.
- They are easily distracted by animals or other events.
- They may choose trails or tracks that are not easily identified by adults.
- They will search out shelter when they get tired.
- They may not respond to either calls or whistles.

Potential places to search - Look along trails, tracks, or shortcuts as animals and the terrain may influence their choices. Also, they may be found in buildings, vehicles, playgrounds and in their *secret* place.

7.7.1.3 Children 7 to 12 years of age

- They are developing their directional and navigational skills.
- They can orient themselves to familiar places but they can become confused in new locations.
- They can become lost when taking a shortcut to a familiar place.
- They may intentionally run away when they are upset or trying to avoid

punishment, or to garner attention.
- They may become upset, angry or confused when they become lost and react irrationally.
- They may resort to running along trails, taking them farther away.
- They may not respond until they get cold/wet/hungry.
- They are often found in their *secret play places or their hideouts*.
- They appear more mature with their friends or siblings,

Potential places to search - Look along trails, tracks and shortcuts, as animals and the terrain, may influence their choices. Also, they may be found in vehicles, playgrounds, and places where animals can be tracked and in their *known* secret play places.

7.7.1.4 Youth 13 to 15 years of age

- Directional and navigational skills are much more developed than younger children.
- While engaged in more adventurous activities, exploration or in groups, they frequently become lost.
- They rarely venture far while in groups.
- They will usually respond to whistles or voices.
- They will often try looking for familiar places or landmarks - *directional sampling*.
- With their friends, or siblings they may appear to be more mature.
- When trying to *find* themselves, they may panic and resort to irrational tactics.

Potential places to search - Look along trails, tracks and shortcuts as animals and the terrain may influence their choices. Also, any *known* special places.

7.7.1.5 Despondent

- It is not their intention to travel any distance, but to find a place of solitude, where they can contemplate suicide.
- Often found where two different types of terrain meet.
- Often found at a scenic vantage point, or well-known picturesque spot that may overlook civilization.
- Rarely found in the bush, often located within sight and sound of civilization
- They rarely respond to either calls or whistles and they may even actively evade searchers.
- This group has an extremely high fatality rate. Often alcohol, drugs or both are involved.

Potential places to search - Scenic locations, high points overlooking civilization or points of interest. Favorite walks, trails, or places frequently visited. Places significant in their lives. There are two groups within this category. The first group will travel great distances in order to reach the *chosen* location and the other group that is just looking for an undetectable spot.

7.7.1.6 Psychotics

- This group will run away and hide or just try to be evasive.
- Most will not respond to their name.
- Purposeful travel is rare.
- Medications or the lack of them may be the problem.
- They may be frightened of authority or of being found.
- They may become aggressive so be aware of the safety of the searchers at all times.
- Their behaviors may be hard to predict.
- They are not often *lost* in the traditional sense of the word.

Potential places to search - This group is not likely to travel deep into the woods or thick undergrowth. They are usually located at the edges of the woods, in buildings or along the roadways. Also, they have been found on trails, along streams and by drainages.

7.7.1.7 Mentally challenged

- They lack the concept of being lost.
- They have good *survivability*.
- They rarely respond to either whistles or calling their name.
- They may also have some physical limitations
- They rarely have a set plan and may wander on a variety of paths or trails travelling deeper into the woods.
- They are easily distracted.
- They may do little to help themselves, though they may look for some shelter.
- They may run away from searches and unfamiliar people.

Potential places to search - Forests, trails, dense brush, buildings and vehicles. They may not follow a distinct track but alter course at will. Many have been located in drainages.

7.7.1.8 Alzheimer's

- Often set off with a planned location.
- Often they have poor memory
- They may not recognize either familiar surroundings or any potential hazards.
- They may have hallucinations.
- They are easily distracted.
- They may have a history of wandering.
- They may easily become disoriented when leaving their residence.
- They may also have coexisting medical conditions.
- They can easily over-exert themselves.
- They will not respond to shouts or cry out for help.
- They may be looking for a private place to urinate
- They will not leave many clues.
- If not found, they will succumb to the environment (dehydration/hypothermia).

Potential places to search - Close to their residence, not far from a road. Usually found in a creek/stream or drainage or tangled in bushes, fighting until they are stuck. They may cross roads or follow trails. They may have a destination in their mind and they may attempt to go there.

7.7.1.9 Hikers

- They are *trail* oriented and can become confused when the trail is altered, obscured or if there is a confusing intersection of trails.
- Hikers are more dependent on trail signs and navigational aids.
- They tend to travel much farther than any other group.
- Some hikers are not physically prepared for the terrain and may end up lagging behind.
- Some hikers will move to a high spot or trail run in order to determine where they are.
- They may travel along lines of *least resistance* (following a stream or the edge of a forest).
- They may revert to less effective methods if they start to panic.
- They want to be found and will look for or prepare a shelter if injured or in anticipation of an overnight stay.

Potential places to search - Look along paths of least resistance, tracks, trails and edges of the forest. Also check sheltered areas and high grounds or lookouts.

7.7.1.10 Hunters

- They may become distracted when concentrating on game.
- They may become disoriented after tracking a wounded animal into dense or unfamiliar brush.
- They may overexert themselves, pushing past their physical abilities.
- They will respond to calls and whistles. May fire shots to attract searchers.
- Hunters may try to walk out at daybreak.
- They may make a shelter for the night or from the weather.
- High survivability rate.
- Easy to see if wearing *hunter orange*.

Potential places to search - They may follow drainages, or go cross-country. They may have underestimated the time of day or the changes in the weather. Most are communicative.

7.7.1.11 Fisher-person(s)

- Fishing from a boat, shore or in the middle of the river, stream or creek.
- Usually well oriented to the area that they are in.
- They are usually late because of accident (falls) or injury (hypothermia).
- Searchers should consider additional information:
    - Check water and weather conditions at position last seen (PLS).
    - Did the fisher-person(s) have to hike to get to their *spot?*
    - Look for any related fishing paraphernalia along any water access.
    - Is there any evidence of either alcohol or drugs at the *spot?*
    - Check along the shore line and downstream for any sign.
    - Water recovery of a body is commonly associated with this group.
    - In swift waters, the person(s) can be carried downstream quite far or be trapped by debris or obstructions, allowing for the clothing to be torn from the body.

Potential places to search - Search along the shoreline, and downstream from any known points. Locate the boat and check the wind direction and wave conditions as well as the strength of the current. Probe downstream eddies and pools and look for any related clothing. Also check the bird activity along the water way.

7.7.1.12 Boaters

- They are usually well oriented.
- They may take shelter in bays to wait out the weather.
- They are often delayed by mechanical breakdowns.
- If they remain with their boat, they are easy to detect.
- If they capsize, they usually suffer from hypothermia.

Potential places to search - Lees and shelter bays and eddies if capsized.

7.7.1.13 Mountain bikers

- They usually are riding on known trails in a group, either in the back country or in the front country.
- They are usually focused on their activity.
- The can cover a great deal of territory in a short time.
- As a last resort, they will ditch their bike usually due to mechanical problem (flat tire, bent rim, etc.).
- They may try to take a short cut that may lead them into additional problems.
- Some cannot return to the start point on time as they have travelled too far, or the terrain has become too difficult for their physical conditioning.
- Injuries occur during the ride that will make timely arrivals unlikely.

Potential places to search - Check local bike trails, roads and highways leading into and out of the search parameters. Also check drainages and animal trails, as well as any confusing or ill marked trail junctions. Use any local mountain bike guides and trail maps.

7.7.1.14 Climbers

- They are generally well equipped and very self-sufficient.
- They tend to remain on or near their designated routes.
- Weather or hazardous conditions may hamper their abilities.
- Back country climbers may be delayed due to the technical requirements of the terrain, or injury. Falling is a major cause of injuries.
- Injury may occur from falling debris or avalanche.
- Rescuing requires specialized personnel and equipment.

Potential places to search - Check near their scheduled climb location, or along the planned route.

7.7.1.15 Cross country skiers

This includes both novice and experienced, back and front country skiers.

- They are usually well equipped and dressed for the weather.
- Park maps and kiosks are relied upon by those using groomed trails.
- Some travel with only minimal equipment and light clothing.
- Some novice skiers may wear inappropriate or not enough clothing for the weather conditions
- Weather and fatigue are important factors in determining the safe arrival at their destination.
- People now a days do not spend long periods of time out of doors, in all weather conditions.
- Some people are not prepared to spend the night and with diminished light, confusion can set in.
- They want to be found and will call out and respond to whistles

Potential places to search - Look around the trail head for indicators of entry. Check intended destination. Look along trails and check for any hypothermia signs along the trail (discarded clothing, packs etc.). Check water sources for sign that someone may have fallen through. You should probe snowdrifts and mounds following an avalanche.

7.7.1.16 Off road vehicle users (Snowmobile and ATV)

- They can travel very far in a short period.
- Mechanical problems, getting stuck and running out of fuel are the main reasons for being late.
- Usually unprepared for extended stay, with most not carrying spare parts or fuel, maps, or survival gear.
- Speed related accidents and injuries are usually the result of inexperience, size of the machine and the age of the user.
- They will often take unnecessary chances on thin ice.

Potential places to search - Check local maps and recreational trails. Check anticipated destination. Look for any confusing junctions; look for obvious mechanical problems (oil, fluids). Check along waterways for broken ice. Check restricted areas for A TV's.

7.7.1.17 Miscellaneous Adults

This group includes migrant workers, photographers, rock hounds, surveyors, forestry workers and conservation officers etc., who engage in some form of outdoor occupational activity.

- Often inadequately equipped for the terrain.
- Many are found away from the trail.
- Often they have entered the woods when the weather was good, but they are not prepared for any weather changes and panic may set in.
- They are often ill equipped with emergency supplies, maps or additional clothing.
- They may become easily disoriented.
- They are a high survival risk.
- They will respond to both calling and whistles.

Potential places to search - Usually located near a natural boundary (forest edge, stream, steep slope, fence lines, shelters etc.).

Missing or lost person(s) do not always behave rationally. Fear often takes over good judgment of a person who otherwise would make good decisions. Panic may result in aimless running or frantic scrambling, often resulting in injury and fatigue.

Most are poorly equipped and those that are equipped forget to use equipment or lose it or discard it along the way. Few light fires or build a shelter. Often if a shelter is built the missing or lost person(s) may make the situation worse by creating a camouflaging effect.
Missing or lost person(s) often shed clothing along the way. They do not realize people are looking for them and don't make their presence known by marking a trail or using signals. Some may even hide. It is difficult to say what a person will or will not do. Ultimately, the goal is to find the missing or lost person(s) before time runs out.

7.7.2 Strategies Missing or Lost Person(s) Use to Re-orient Themselves

It is important to know how the missing or lost person(s) tries to get *un-lost* or find their way back to a familiar location. The following are some strategies that may be used, when a person(s) is trying to re-orient themselves, they may use one method or they may try them all.

7.7.2.1 Random Travelling

Totally confused and usually experiencing high emotional arousal, the missing or lost person(s) moves around randomly, following the path of least resistance, with no apparent purpose other than to find something or some place that looks familiar. Although many lost people move randomly during their initial reaction to being lost, most settle down and apply a more effective method.

Only a few missing or lost person(s), such as some school-aged children by themselves, will continue to move randomly while lost. Most subjects show somewhat more purposeful behavior in their attempt to get out of the situation.

7.7.2.2 Route Travelling

In this case, the missing or lost person(s) decides to travel on some trail, path, drainage or other travel aid. The route is unknown to this person, and he/she is uncertain regarding the direction he/she is headed, but hopes that eventually he/she will come upon something familiar. When this fails, as it often does, they rarely reverse direction on the route to go the other way. If the trail peters out, for example, he/she may revert to *random travelling.* Sometimes referred to as *trail running,* this is usually an ineffective method of reorientation, shown most often by school-aged children up to 12 years of age.

7.7.2.3 Direction Travelling

Certain that safety lies in one particular direction, the missing or lost person(s) moves cross-country, often ignoring trails and paths leading in the *wrong direction*. Sometimes, in fact, this person will cross railroad tracks, power lines, highways and even backyards in the conviction that he/she is headed the right direction. Unfortunately, this strategy (which is rarely effective) often puts him/her into the thickest part of the woods, making him/her especially difficult to find. It takes considerable over confidence about one's sense of direction to employ this tactic which, however, is not uncommon for subjects of land searches. Most typically, it is seen in some hunters who have come to exaggerate their outdoor skills to others and to themselves, believing there is some sort of shame in becoming turned around. This is not a recommended strategy. However, some missing or lost person(s) try it and have been known to walk across roads and trails.

7.7.2.4 Route Sampling

In route sampling, the person uses an intersection of trails as a base, travelling some distance down each trail in search of something familiar. After *sampling* a particular route without success, this person returns to the intersection and tries another path, repeating the process until all routes at the intersection have been sampled. 3 possibilities arise:

- He/she may repeat the sampling procedure, but now travels further distances on each route
- He/she may choose to proceed down the likeliest trail until he comes to another intersection where he can repeat the strategy
- He/she may decide to try another tactic.

Older children and adolescents sometimes report having tried this method of reorientation. It can be an effective method when combined with the *backtracking* mode*.*

7.7.2.5 Direction Sampling

Direction sampling is similar to route sampling, except that the missing or lost person(s) does not have the advantage provided by an intersection of trails. Rather, this subject selects some identifiable landmark as a base, such as a large tree or outcropping. From there, he/she goes in selected directions, always keeping the base in view, looking for something that will help figure out where he/she is. When the individual(s) is just about to lose sight of the base, they return to it and sample another direction, repeating the process until all possible directions are tried. Often, however, subject(s) does lose their

base before the sampling procedure can be completed. At that point he/she tends to move somewhat randomly until they find a landmark suitable for serving as a new base, and the directional sampling strategy may be started anew. This method is recommended by some.

7.7.2.6 View Enhancing

Unable to find anything familiar after travelling around the woods, the missing or lost person attempts to gain a position of height to view landmarks in the distance. This person attempts to enhance his/her view by climbing a hill, ridge, or tree. A knowledgeable adult with a topographic map or at least some survey knowledge of the area, surrounded by dense vegetation, might attempt reorientation by climbing a hill (sometimes a tree if this can be done safely) and matching visible terrain features with those on the map. In fact, many subjects with outdoor experience report *view enhancement* as a favorite method of reorientation. With cell phones, more missing or lost person(s) use *view enhancement.* However, instead of moving uphill to obtain a view, they gain elevation in an attempt to obtain cell power signal. Missing or lost person(s) will leave trails and other travel aids and often head directly uphill. When the strategy works, the SAR planner will know (they will get a call); when it does not, it may complicate the search process.

7.7.2.7 Backtracking

After getting turned around, the missing or lost person(s) reverses the track and attempts to follow the exact route back out of the woods. This can be a very effective method. It does require some skill and patience to use. Unfortunately, missing or lost person(s) seem reluctant to reverse their direction of travel without good reason, believing it to be a waste of time and that safety might be over the next hill or around the next bend in the trail.

They also know that something bad already occurred in the return direction (*they got lost*). If a person becomes confused on a route that has numerous branches, he/ she can backtrack to each intersection, and employ a *route sampling* tactic to determine the correct fork. If this person(s) is in the woods, and competent at reading tracks, they should be able to follow their own sign back. However, this can sometimes be a very difficult task.

7.7.2.8 Folk Wisdom

This miscellaneous category refers to the attempt to re-orient oneself by using any of the numerous adages on how to find your way safely out of the woods. These adages are usually passed on by the campfire or disguised as *facts* in survival books. The most common of these is *all streams lead to civilization* a principle that, if followed in Nova Scotia, will more than likely lead the missing or lost person(s) to a remote and bug infested swamp. In the dry domain, mountain streams often simply end as a wash in the middle of the desert.

7.7.2.9 Staying Put

Every woods safety program stresses the importance of *staying where you are* when lost, which can be considered excellent, *if somewhat passive,* strategy for reorientation, as long as the missing or lost person(s) can reasonably expect a search to be organized on his/her behalf in the very near future. Sadly, very few people apply this method of getting out of the woods safely. While it is true that most person(s) are found in a stationary position (especially after the first 24 hours of the search), this is usually because they are fatigued, asleep or unconscious. One survey of person(s) with excellent outdoor experience revealed that they are aware that staying put is the recommended course of action. However, they may be disinclined to stay in one place for any length of time, especially during the day.

7.7.2.10 Doing Nothing

While not a strategy at all for getting found, it is listed that doing nothing is an option. In one sense it could be viewed as *staying put*. However, some subjects made an active decision to stay put but attempted to signal and/or build a shelter, and others did *nothing at all.* The *doing nothing* approach was often applied to dementia cases in which the subject simply sat down.

7.7.3 The Role of Emotion

Fear of the woods - several studies report that children and teens are frequently afraid of the woods, even though these same children and teens also indicated interest in visiting these woods.

Most children and many adults have apprehensions about entering the forest, especially alone. It is rarely the woods they fear, but the objects or experiences that may be found there. People don't fear clumps of trees so much as the bears and other dangerous animals, as well as darkness, the ghosts and the strangers lurking there, no matter how unrealistic these fears may be.

Fear of getting lost - studies of fears revealed that the *dread of getting lost is common* in children and adults alike. More recent studies confirm that many people fear getting lost, especially in wooded environments. For children beyond the age of about 4, such fear will be exacerbated by numerous other fears, described above, with the result that the child may become terrified and nearly non-functional. It is common for lost children to hide from searcher, to ignore their calls and to stand petrified at the approach of a helicopter; not simply because they've been taught to avoid strangers, as is often believed, but because every strange stimulus under such conditions is a source of terror.

Wood shock - there are various reports of high arousal having detrimental effects on the mental processes of missing or lost person(s), going back more than a century. A popular theme in search and rescue lore is seen in stories of missing or lost person(s) who, in a state of shock, have walked trance like past search parties, or had to be chased down and tackled by their rescuers. Such observations confirm that it is not only the child or the inexperienced outdoorsman who is vulnerable to the adverse effects of

emotional arousal. Indeed, the extent of one's outdoor experience is not always a very good indicator as to how rational someone will behave upon becoming lost.

Strength in numbers - one of the least studied aspects of missing or lost person(s) behavior is the possibility that people act differently when they are lost in the company of one or more companions than when they are alone. In most multiple subject searches, it has been found that missing or lost person(s) often stay together. From talking with missing or lost person(s) soon after rescue, it is found that with companions people are much less scared and considerably more rational during their ordeal than are people lost by themselves. This seems especially true for children of school age who almost never show the same panic reaction when in groups than when alone.

In summary becoming lost is normally accompanied by high emotional arousal, which if high enough, tends to interfere with mental functioning, specifically the application of rational thought processes toward solving the problem of getting re-oriented. Fear of the woods and especially fear of being lost are common among children and adults alike. Even experienced outdoorsmen may sometimes react to being lost with an extreme form of fear termed *wood shock*, evidenced as a nearly complete loss of rational thought accompanied by an apparent inability to recognize scenes or landmarks normally familiar to them. However, there are indications that when people are lost in groups of two or more, their arousal levels may be somewhat lower and they may behave in a much more rational manner than when lost alone.

Recommended reading:

- Psychology of Lost- Kenneth Hill
- Lost Person Behavior, Managing the Lost Person Incident- Kenneth Hill
- Lost Person Behavior – Robert Koester

Practical Exercise

This exercise will allow the searcher to understand and practice using the Missing or Lost Person(s) Behavior and Characteristics information to limit the search parameters and best utilize the resources available, and also to predict the likely location of the missing person.

Choosing any category; a scenario can be developed incorporating the known characteristics of that group (for example - Hikers).

Scenario - A search has been called out for 2 missing hikers, last seen entering the trail head on a well-used trail. They are novice hikers and are carrying light packs. They are overdue.

Assignment - Determine the course of action. What steps would you use to determine the start point, and how to deploy the limited resources available? Follow decisions to locate the missing hikers.

Expectations - Dividing up the searchers to deploy for the optimal outcome. Hasty search for clues along the trail and any altered directions at intersecting trail crossings as well as along the edge of the forest, roadways and paths. Look for navigational aids (trail markers) and obvious clues. Utilize Track Crawl for a more thorough search for clues along the trails and for sign cutting. Using whistles or calling, locate the missing hikers. Treat for any first aid requirements.

7.8 Team Roles and Responsibilities

OBJECTIVE: Describe roles and responsibilities for members on a SAR team.

Successful searcher operations often depend on the searcher's skillset and knowledge of the different roles and responsibilities assigned to each member. In order for searchers to become proficient at the required skills, they must be trained to an acceptable standard. This section is designed to provide suggestions on how to provide practical training to each member, enabling them to become effective in their roles and responsibilities while on search. There are several roles on a search line, these will include:

- Team Leader
- Flag Person(s)
- Communications Person
- Navigator
- Medic/First Aider
- Note Taker
- Searcher

It is important to note that while each of the roles can be designated to individual members, often a searcher will assume responsibility for multiple roles.

7.8.1 Team Leader

Training for the team leader must include all the training a Basic searcher is required to have. In addition the team leader must process leadership skills and be able to adapt to different situations that may occur. Members of the search team rely on the team leader to make informed and educated decisions involving their welfare and safety.

The team leader requires training and experience in field operations to learn how to control a search line. They must decide upon critical separation/distance, recognize searcher fatigue, clue recognition/preservation and be able to assign roles and responsibilities, just to name a few attributes.

The only way to ensure a team leader is trained to a standard where they are capable of leading a team is through field practical exercises in which they are to lead their respective teams. Start by having the team leader receive assignments from command post, assign roles to members of the team, check to ensure that members are adequately equipped, issue team equipment (i.e. radios, GPS), and conduct team briefings.

Now that the team is ready to start the search, have the team leader ascertain the critical separation/distance and begin the search of the assigned area. Team leaders are responsible for the entire team as they make each pass. Clues may be placed within the search area to ensure searchers are focused and are travelling at an acceptable speed to find the clues. Any clues found, should be called in to command post and proper team protocol for clue handling, followed. The team leader must ensure the team maintains their designated bearing, flagging and /or string lines have been laid where required. As well, have the team call out to the lost person stopping occasionally to listen for a response. The team leader must also ensure that members of the team stay focused - looking up, side to side and rearwards to lessen the possibility of a clue being overlooked. Upon completion of the task the team leader will debrief the team. This is a good opportunity for the team leader to be critiqued by the team and for the searchers to be critiqued by the team leader. The best way for a team leader to become proficient at leading is to lead.

7.8.2 Flagging Person

The flagging person is responsible for the laying of flagging tape and/or hip chain where required. The best way to train for this role is to do conduct search scenarios/exercises. Before leaving the staging area, the flag person must ensure they have an adequate supply of the correct colour(s) of flagging tape and hip chain. Before the search team begins the sweep, the flag person must clearly mark the starting point (usually with a double strand of tape or a different colour of tape). The starting point may also be identified by securing a note to the flagging tape. To lay flagging tape, simply loop it through itself. Do not make knots as this will make it difficult and time consuming to remove it on the return or second pass/sweep.

During the sweep, the flag person is required to place flagging tape/hip chain along the team's boundary at close enough intervals that it can be easily spotted on the return pass/sweep, or by another team. On the reverse sweep a flag person will have the responsibility of removing the flagging tape on the team's inner boundary, while another flag person will be laying tape on the team's outer boundary. The flag person must also remain focused and be searching during the each pass/sweep. Upon completion of the sweep, the flag person must again ensure that exit points are clearly identified.

7.8.3 Communications Person

The communications person is assigned by the team leader but is usually a team leader responsibility. For information on radio communications, see Section ***6.1 Radio***.

7.8.4 Navigator

Much of the training for the navigator can be completed during classroom sessions (see Section ***7.5 Navigation***), but all practical training will be conducted while on field training exercises. While at the staging area, the team leader will appoint a navigator and issue him/her a GPS. The navigator should be familiar with the GPS. They will ensure that it is working condition and with correct settings. The navigator will also ensure that they carry spare batteries. The navigator must then set the correct declination on their compass as provided by the command post, and collect required

map(s) of the area. The navigator may or may not be responsible for searching (a team leader decision).

7.8.5 First Responder / First Aider

Searchers should receive their training from a recognized organization (Red Cross, St, John's) and maintain their certification.

7.8.6 Note Taker

For information on note taking, see Section ***2.15 Note Taking***.

8 Glossary

- ***Agency*** - an agency is a division of government with a specific function, or a non-governmental organization (e.g. private contractor, business, etc.) that offers a particular kind of assistance. In ICS, agencies are defined as jurisdictional (having statutory responsibility for incident mitigation) or assisting and / or cooperation (providing resources and / or assistance).
- ***Aging Sign and Track*** - the ability to determine how long ago a particular piece of sign or track was produced.
- ***Assignment*** - the task assigned to a member of the search team that falls within their scope of training.
- ***Attraction*** - a search tactic involving attempts to signal the subject and get him or her to travel toward searchers. Techniques include the use of sound as well as visual signals.
- ***Azimuth*** - same as bearing. Refers to the degree of bearing from your current position to a landmark or destination. Reversing the bearing would be known as a back azimuth or back bearing.
- ***Back Bearing*** - the 180º opposite of the azimuth or bearing. Also known as a back azimuth.
- ***Back Country*** - the area beyond mid-country access. More than four hours walking distance of a vehicle-navigable road/track or trail head.
- ***Base*** - the location at which primary logistics functions for an incident are coordinated and administered. There is only one base per incident. The command post may be co-located or shared with the base.
- ***Basic Life Support*** - a combination of emergency responses which maintains the ABC priorities: AIRWAY, BREATING, and CIRCULATION.
- ***Bearing*** - the direction of travel from your current position to a landmark of destination expressed in degrees from 1 to 360. Same as azimuth.
- ***Belay*** - to belay is to use a rope or ropes attached to a secure position and used to steady the movement of stretchers or to facilitate the secure movement of searchers up or down a slope.
- ***Bench Mark*** - a permanent object that is either natural or man-made and is a known elevation that can be used as a reference point when navigating.
- ***Binary Search*** - a search strategy that involves sending sign cutters in a direction that is perpendicular to the subject's assumed direction of travel, in an effort to narrow down the size of the search area.
- ***Briefing*** - the process of providing searchers with the information they need to adequately perform their task.
- ***Call-out*** - the executive command to mount an operation whereby all personal are required to deploy.
- ***Camp*** - a geographical site, within the general incident area separate from the incident Base, equipped and staffed to provide sleeping, food, water, and sanitary services to incident personnel.

- ***Cardinal Points*** - the four main points of direction on a compass are North, 360º; East, 90º; South, 180º; and West, 270º.
- ***Closed Grid Search*** - a closed grid search will normally be carried out with searcher spacing of less than 10m. This method is considered extremely thorough and is often taken as evidence that the victim or clue is not in the area searched.
- ***Clue*** - a message or signal that serves to reduce uncertainty with respect to the subject's location, as well as identification purposes for police authorities.
- ***Clue Awareness*** - the ability to perceive clues left by the subject (i.e. tracks and other sign), rather than just the subject.
- ***Command Post (CP)*** - that location at which the primary command and control functions are executed. It is usually located with the search base.
- ***Command Staff*** - in ICS, those officers who contribute to the command function and report directly to the Incident Commander (or Search Manager) and may include Safety Officers, Liaison Officers, Information Officers, and Technical Specialists.
- ***Confinement*** - confinement procedures ensure that the subject of a search cannot leave the area without the searchers being aware of the departure. Some of the techniques used are: road blocks, trail blocks, lookouts, camp-ins, track traps and string lines.
- ***Containment*** - taking steps to ensure that the subject does not travel out of the search area, aka confinement.
- ***Contour Lines*** - each contour line on a map comprises an often irregular closed loop that connects points of equal elevation. Elevations are printed on some of the lines on a regular basis and elevations refer to elevation above sea level.
- ***Critical Incident*** - An incident causing such a high level of psychological stress that many exposed to it, develop immediate or delayed stress reactions.
- ***Course Deviation Indicator (CDI)*** - is typically displayed with a line or an arrow as an indicator of your being on or off course when following a route.
- ***Critical Incident Stress Debriefing (CISD)*** - is a form of limited intervention that is highly effective in preventing many of the ill effects resulting from exposure to a critical incident and its immediate and delayed stress reactions.
- **Critical Incident Stress** - psychological stress resulting from specific critical incidents that cause high levels of psychological (but not necessarily physical) stress.
- ***Critical Separation*** - Critical separation is determined by two searchers walking away from a simulated subject in opposite directions, until each searcher can just see the simulated subject. The distance between them is the critical separation.
- ***Cumulative Probability of Detection*** - the overall probability of detection that results when a segment has been searched more than once.
- ***Cumulative Stress Reaction*** - a set of abnormal and mal adaptive responses to chronic high levels of stress.
- ***Datum*** - the most probable position of a search object, corrected for drift, at any specific time.

- ***Datum Line*** - a line that runs perpendicular to the base line of a search area and are usually marked at either end of the search area to define the area adequately.
- ***Debriefing*** - the exchange of information, usually at the close of a situation that conveys important knowledge and experience. In critical incident stress management, a meeting between peers and a trained counselor after a stressful encounter at which techniques of review are used to defuse the cumulative effects of psychological stress.
- ***Declination*** - the difference in degrees between magnetic north (the direction the magnetic needle on compass points) and true or geographic north (the direction maps are printed towards).
- ***Delayed Stress Reaction*** - a psychological reaction characterized by unusual physical, emotional, cognitive, and behavioral signs and symptoms. Often occurring weeks or months after exposure to a critical incident and often triggered by a seemingly in nocuous stimulus.
- ***Despondent*** - a type of missing person who is severely depressed or suicidal.
- ***Differential GPS (DGPS)*** - a system which incorporates a stationary GPS receiver at a known position which calculates the cumulative positioning error and transmits a correction factor by radio/modem signal to other GPS receivers, the objective being a more precise fix.
- ***Distress*** - a search and rescue incident where there is a reasonable certainty that one or more individuals are threatened by grave and imminent danger and require immediate assistance.
- ***Distress Alerting*** - the reporting of a distress incident to a unit which can provide or coordinate assistance.
- ***Distress Beacon*** - a generic term used to describe any emergency locator transmitter (ELT), emergency position-indicating radio beacon (EPIRB), or a personal locator beacon (PLB).
- ***Emergency Locator Transmitter (ELT)*** - aeronautical radio distress beacon for alerting and enabling rescue units to locate the scene of the distress.
- ***Emergency Measures Organization (EMO)*** - provincially mandated organization responsible for plans and operations of major emergency events in the province.
- ***Emergency Position-Indicating Radio Beacon (EPIRB)*** - a marine radio distress beacon carried aboard maritime craft, that transmits a signal that alerts search and rescue authorities and enables rescue units to locate the scene of the distress.
- ***Estimated Position Error (EPE)*** - a number expressed in feet or Metres, and is an indicator of the expected accuracy of the coordinates shown on the GPS in real time.
- ***Evidence*** - something legally acceptable before a court, such as an object or a witness, which bears on or establishes an issue. In tracking, evidence is divided into physical and incorporeal.
- ***Evidence Search*** - the facts, circumstances and proof that a certain chain of events have taken place in regards to the subject of a search.

- ***Field Evacuation*** - the removal of a person, usually injured of adversely affected, from an isolated wilderness environment to a secure staging area, command post, or control centre.
- ***First Responder*** - a person trained in the medical and mechanical skills and knowledge necessary to successfully manage the care of an individual on the first discovery until the person can either be evacuated or placed under more intense care. The term *First Responder* is usually associated with police, fire and ambulance response in the non-SAR environments.
- ***Front Country*** - the area within one hour walking distance of a vehicle-navigable road/track or trail head.
- ***Geographic Information System (GIS) Mapping*** - is system of computer software, hardware and data that will analyze and present information that is tied to a spatial search area.
- ***Global Positioning System (GPS)*** - a specific satellite-based system used in conjunction with mobile equipment to determine the precise position of the mobile equipment.
- ***Grid Location*** - most maps used in search and rescue have a grid superimposed to aid in describing the location of particular points. The rectangular grid runs approximately north-south and east-west. A point on the map can be described by its position relative to the grid.
- ***Grid Search*** - an attempt to find the subject (or clues) by lining up 3 or more searchers and having them proceed in a parallel fashion through their assigned search area (aka *sweep*, *line*, or *creeping line* search).
- ***Ground (or Ground SAR Incident)*** - a *ground* search or rescue activity is one that occurs on land. For the purposes of these procedures, this includes the ground portion of all activities associated with missing aircraft, and the air portion of all activities involving searches for or rescues of people on land.
- ***Ground Search and Rescue (GSAR)*** - the conduct of a search and rescue operation to assist persons lost, stranded, trapped, or injured in an area on land. In northern areas, GSAR also includes operations on frozen waters where *ground* approach is the most appropriate means of pursuing the incident.
- ***Ground Search Party*** - a group formed to conduct all or part of an organized GSAR operation.
- ***Hasty Search*** - an initial response aimed at searching high probability areas, trails and likely spots, usually by the Hasty Team.
- ***Hasty Team*** - a group of trained individuals, usually part of a police organization that can be convened quickly for the purpose of responding to an emergency situation.
- ***Hip Chain*** - used to measure distance. It is a belt case containing thin string that runs through a measuring device that registers as the string is paid out. Biodegradable string is recommended for a hip chain.
- ***Human Trackers*** - searchers who attempt to follow the visible signs left by the lost person (aka *man-trackers* or *visual trackers*).
- ***Hypoxia*** - low oxygen levels.
- ***Incident Action Plans*** - in ICS, the plan for an incident, including the incident objectives and other planning documents.

- ***Incident Base*** - the area where all primary incident services and support activities are located.
- ***Incident Commander*** - an individual charged with functional responsibility for an entire incident. Not necessarily the highest-ranking official, just the one in charge.
- ***Incident Command System (ICS)*** - a widely applied management system for handling any type of emergency incident or public event.
- ***Incident Critique*** - procedure for constructive review of an incident.
- ***Incident Objectives*** - part of the Incident Action Plan, a document outlining search objectives for the current operational period.
- ***Information Officer*** - the officer in the Command Staff who serves as the initial contact person for the media and other persons seeking information about the incident.
- ***Initial Response*** - the first response to a search event usually by a small team of 3 searchers that are fit, fast and skilled that can quickly search high probability areas. Initial response teams are usually trained beyond the level of the basic searcher.
- ***Latitude*** - the distance in degrees north of south from the equator. These lines run laterally (horizontally) around the globe and parallel to the equator. One minute of latitude equals one nautical mile.
- ***Likely Spot*** - features or areas that may offer attraction to the missing or lost person(s).
- ***Listening Post*** - can be established anywhere in and around the search area where there is a chance that a searcher may overhear the subject of a search trying to get someone's attention.
- ***Longitude*** - the distance in degrees east and west from the prime meridian established in Greenwich, England. These lines run vertically (lengthwise) around the globe and connect each pole.
- ***Lookout*** - is a searcher who takes a position on a hill or ridge affording a view of several potential travel routes. A lookout will have a radio and a set of binoculars and will often work with a partner at a lower elevation to inspect suspicious objects found by the lookout.
- ***Lost Person*** - a known individual in an unknown location, whose safety may be threatened by conditions related to the environment or other factors. Also, the person being tracked or looked for in a SAR incident.
- ***Lost Person Behaviour*** - the travel and self-help behaviour generally exhibited by persons in various age groups, mental conditions or demographic type when lost.
- ***Lost Person Incident*** - an organized search for a person who has been reported missing to a jurisdictional police authority.
- ***Lost Person Profile*** - a vivid biographical and character sketch of a lost person, derived from information gleaned through investigation, interviewing and the Lost Person Questionnaire.
- ***Lost Person Questionnaire*** - a written document that describes all available physical and mental characteristics of a missing or lost person(s).

- ***Magnetic North*** - the geographical region towards which all magnetic needles point. This point is approximately thirteen hundred miles south of the true north and moves slightly each year due to the earth's rotation and the friction between its solid crust and liquid centre.
- ***Marine SAR*** - the employment of vessels and/or aircraft for the conduct of a SAR operation that occurs on or under water.
- ***Medical Plan*** - the plan for treating and evacuating injured searchers.
- ***Memorandum of Understanding*** - an agreement drawn up to clarify roles, responsibilities, functions and procedures between two or more organizations. Not binding as a contract, but important to establish understandings and arrangements prior to the occurrence of an emergency situation.
- ***Mid-Country*** - the area within 1 to 4 hours walking distance of a vehicle-navigable road/track or trail head.
- **Military Grid Reference System (MGRS)** - a shortened version of UTM coordinate display currently in use by SAR.
- ***National Search and Rescue Secretariat (NSS)*** - reports to the Lead Minister for SAR (currently the Minister of National Defense), coordinates the National Search and Rescue Program which aims to facilitate SAR prevention and response services of involved agencies and to maintain a coordinated national perspective on SAR.
- ***Operational Period*** - the period of time for which there is a separate overhead team and Incident Action Plan; normally 12 hours.
- ***Orienteering*** - using map and compass in the field to determine your route of travel. Has commonly come to mean a type of competition at which competitors try to navigate across challenging terrain from point to point arriving at the finish first.
- ***Pace*** - the distance between two successive stationary positions of the same foot in walking. (For example: 122 steps would equal 61 paces)
- ***Passive Search Techniques*** - passive techniques can include such procedures as looking out or listening, or attraction using light or sound to draw the subject of a search to you as opposed to going out and looking for the subject.
- ***Performance Objective*** - a level of skill of performance that must be attained as part of a training program.
- ***Perimeter Cut*** - experienced trackers may be able to check the Last Known Position (LKP) for tracks, clue, direction of travel, etc. and then sign cut the perimeter of the area to determine if the subject has left the search area; therefore eliminating the need to search it.
- ***Personal Locator Beacon (PLB)*** - personal radio distress beacon for alerting and transmitting homing signals.
- ***Point Last Seen (PLS)*** - an essential bit of information when initiating a search, PLS comes from a reliable source that may describe the direction of travel, the time that the missing or lost person(s) was seen and the state of the person (distraught, tired, frisky, etc.). Also described as the location where a confirmed visual sighting occurred.

- ***Police Force of Jurisdiction*** - the police force within whose jurisdiction a GSAR response is initiated. As the search progresses the police force of jurisdiction may change at the agreement of the police authorities involved. The Search Commander will normally be appointed by the police force of local jurisdiction.
- ***Preplan*** - a document which provides incident managers with information, instructions, resource lists, checklists, standard operating procedures, and technical data that will be used during a search incident.
- ***Probability Density*** - the POA of a specific area or segment, divided by the size of the area. High probability density segments will normally receive higher priority.
- ***Probability of Area (POA)*** - the likelihood or probability that the subject is located in a specific area.
- ***Probability of Detection (POD)*** - the likelihood of probability of finding clues (assuming that clues are available to be found), given the nature of the search and the type of resources employed; expressed as a percentage (i.e. 50%).
- ***Probability of Success*** - the probability of finding the subject in a specific place or area, given the type of search tactic employed. Derived from the formula POS=POA x POD.
- ***Professional*** - a person to whom SAR is a principal calling, vocation, or employment requiring specialized knowledge and often long and intensive academic preparation, and characterized by or conforming to technical or ethical standards.
- ***Provincial/Territorial Authority*** - has overall responsibility for the organization and management of ground search and rescue policies within the boundaries of the province/territory, and has the authority to put in place regulatory measures to govern the conduct of GSAR activities within the province.
- ***Record*** - includes all of the expense forms, all of the sign in/out sheets, as well as the communications log and the equipment sign in/out log and any records or documents related to the search that may pertain to evidence and clues found and the outcome of the search. All of this information is kept as part of the teams or associations records for a reasonable amount of time.
- ***Relief*** - the elevations or inequalities of a land surface.
- ***Rescue*** - an operation to retrieve persons in distress, provide for their initial medical or other needs and deliver them to a place of safety.
- ***Rescue Breathing*** - mouth-to-mouth or mouth-to-nose artificial respiration.
- ***Rescue Coordination*** - the function of integrating the efforts of search and rescue (SAR) facilities and resources to achieve concerted and harmonized resolution of SAR incidents in an effective and efficient manner.
- ***Resource List*** - a list of search or logistical resources that can be employed during an incident; part of the preplan.
- ***Risk Control*** - the process of decision making for managing risk and the implementation, enforcement, and re-evaluation of its effectiveness from time to time, with input from the results of risk assessment.
- ***Risk Management*** - the complete process of risk management and risk control. A structured, common-sense approach to reducing the frequency and severity of loss events.

- ***Route (RTE)*** - includes at least two waypoints (up to 20) and at any given time 1 waypoint is the, *from WPT* and the other is the, *to WPT*.
- ***SAR Volunteers*** - members of an organized group of volunteers who assist in the conduct of GSAR incidents. *Organized* means working cooperatively and systematically and apply recognized skills toward the successful resolution of a GSAR incident. There are various configurations of Canadian GSAR volunteers, and many groups have appointed officers to be responsible for different branches of the organization, such as operations, safety, and logistics.
- ***Scale*** - the distance between two points on a map as they relate to the distance between those two points on the earth.
- ***Scenario Analysis*** - an attempt to prioritize the segments in the search area when more than one scenario is present, or when there is conflicting information about the missing lost person's PLS or direction of travel.
- ***Scent Article*** - an article of clothing or other material with which a trailing dog can determine the subject's unique scent.
- ***Search*** - a search involves assembling, coordinating and using the necessary resources to find lost, stranded, trapped, or injured people, to save lives or avoid further injury to them.
- ***Searching Data*** - that information that searchers require in order to search for the lost subject, such as the subject's name, description, clothing, footwear and items carried.
- ***Search and Rescue (SAR)*** - the combined activities and tasks involved in both searching for and rescuing persons who are feared to be in distress. Many searches do not involve rescue and many rescues do not require searches.
- ***Search and Rescue Plan*** - a general term used to describe documents which exist at all levels of the international, national, provincial, and municipal search and rescue structure to describe goals, arrangements, and procedures which support the provision of search and rescue services.
- ***Search and Rescue Unit*** - a unit composed of trained personnel and provided with equipment suitable for the expeditious conduct of search and rescue operations.
- ***Search Commander*** - has the overall responsibility for the execution of the SAR operation and who represents the authority responsible for the area in which an incident has occurred. This is usually a police officer assigned to the search operation by the police force of jurisdiction. In Canadian National Parks, the Search Commander may be a park warden.
- ***Search Dogs*** - dogs who, with their handlers, have successfully completed a course of training resulting in the ability to track missing or lost person(s) and behave under handler control during the search operation.
- ***Search Manager*** - under the general direction of the Search Commander, will manage the search and lead and direct individual SAR resources. Is usually an experienced member of a volunteer ground SAR organization or park warden, forest ranger, or police officer. Under special circumstances the Search Commander may act as the Search Manager.
- ***Search Tactics*** - methods of searching; implementation of strategy.

- ***Search Techniques*** - a body of techniques used in the orderly conduct of a search. These include patterns of coordinated movement, employment of sound or visual signals, self-orientation during movement, and awareness of others and their positions.
- ***Segmenting the Area*** - parceling the search map up into manageable sections or segments with clearly defined boundaries.
- ***Shifting POA*** - changing the probabilities of area after segments have been searched.
- ***Shock*** - an inadequacy of the circulation system which supplies the cells. Shock is marked by pallor and clamminess of the skin, decreased blood pressure, feeble rapid pulse, decreased respiration, restlessness, anxiety, and sometimes unconsciousness.
- ***Sight Line*** - sometimes called line of sight, this refers to the imaginary line that you sight along to take your bearing.
- ***Sign*** - is regarded as evidence of a person's passage through a search area.
- ***Sign Cutting*** - the process of looking for sign along natural barriers such as creeks, banks or roads.
- ***SITREP*** - the short form for situation report, it usually used to give updates to the command post and involved personnel and is often done on a scheduled basis throughout a search.
- ***Sound Sweep*** - sound sweeps utilize sound attraction in combination with wide searcher spacing to cover large search areas. A sound sweep is 3 to 4 times more effective than a visual sweep and is a practical night searching technique.
- ***Specialized SAR Groups*** - groups with special skills needed on GSAR operations and may include police, provincial or federal officials, volunteers, or military personnel. These could cover such special areas as avalanche rescue, cave rescue, cliff rescue, crevasse rescue, flat ice rescue, and underwater photography and rescue.
- ***Spontaneous Volunteer*** - a person not belonging to a participating agency of SAR team who appears at an incident and volunteers assistance.
- ***Staging Area*** - that location where personnel and equipment are assigned to an operational status. Is usually in such a location that resources can be immediately committed to the field.
- ***Standby*** - is the period normally following alert when the Search Commander believes that deployment for the search is imminent. Personnel are placed on standby being ready to respond immediately
- ***Stand-Down*** - that period when the Search Commander declares that the search is terminated, personnel are recalled, debriefed and released.
- ***Stress Defusing*** - a short meeting (30 to 60 minutes) held shortly after an incident, conducted by qualified peer counselors, directed at those people who are assumed to be experiencing stress from the incident.
- ***String Line*** - or hip chain consisting of a spool of thin string and a measuring device that registers as the string is paid out. Can be used to mark search areas and to guide a missing or lost person(s) out of the wilderness. Biodegradable string is recommended.

- ***Subject*** - the object of a search.
- ***Subjective Search Area*** - the reduced area within a theoretical maximum search area which is bounded by physical barriers which would prevent or discourage the search subject from passing them.
- ***Sweep Search*** - can be open grid or closed grid and are conducted in high probability areas as an efficient way to search for clues and subjects. Searchers are spaced in a line according to the urgency assessment and other factors.
- ***Tally System*** - can be used to estimate distance and/or time traveled quite accurately. 1 Tally is equal to 100m and the number of steps taken to cover this distance varies from person to person but once entrenched it is a very useful skill.
- ***Tasking*** - a role delegated to a searcher or to a search team to carry out as part of a search and rescue operation
- ***Team Leader*** - the person responsible for the conduct of a GSAR Team. The Team Leader reports to the Search Manager.
- ***Terrain Analysis*** - an attempt by a search planner to determine how the terrain may have affected the missing or lost person's behaviour, such as mazes, confusion factors, boundaries, and travel aides.
- ***Theoretical Search Area*** - the area that is defined by the distance that the subject could theoretically have traveled in the time elapsed since they became missing.
- ***Track*** - an impression left from the passage of a person or an animal.
- ***Tracking*** - following someone of something by stringing together a continuous chain of their sign. Following a chronology of sign.
- ***Track Trap*** – a track trap is an area that is especially good for finding sign.
- ***Trained SAR Volunteer*** - a person who voluntarily agrees to participate in search and rescue related activities and has attained at least the *Basic SAR* performance objectives suggested by the training requirements for his/her level of involvement.
- ***Training Standard*** - a set of requirements that define the amount and degree of training necessary to qualify a person as *trained* in the subject in question.
- ***Universal Time Coordinated (UTC)*** - a term used to define the 24 hr clock system and sometimes referred to as ZULU or Greenwich Mean Time.
- ***Universal Transverse Mercator (UTM)*** - UTM on most maps is a grid superimposed to aid in describing a particular point. This grid is called a UTM grid and it is rectangular with the grid running north-south and east-west with north being the top of the map.
- ***Unfounded*** - refers to a search subject that was never lost.
- ***Urgency Analysis*** - the use of data collected with values assigned affecting survivability, totaled to give a reasonable estimate of urgency of response.
- ***Ventilation*** - the exchange of air between the lungs and the atmosphere.
- ***Volunteer*** - an individual of group donating time and talents to a specific task or project without salary or compensation other than for allowable out-of-pocket expenses associated with the volunteer activity.

- ***Vulnerability Assessment*** - also known as urgency assessment. The SAR manager will use information collected to develop a relative urgency rating. Values are assigned to different factors affecting survivability and by totaling these values, a reasonable estimate of urgency of response can be determined.
- ***Walk Away*** – a type of missing person with some mental of cognitive deficiency, who has wandered away from a constant care environment.
- ***Waypoint (WPT)*** - a checkpoint used as a point of reference for GPS.
- ***Wide Area Augmentation System (WAAS)*** - a method of clarifying and improving accuracy or displayed coordinates using known ground based locations to accomplish the task (set GPS receivers to use this system whenever possible).

9 References

The following documents were reviewed prior to the publication of this manual. These books and guides could assist you to develop a better understanding for what is truly out there and help you do a better job as a GSAR team member.

Chapter 1

Section 1.1

- BC Ground Search and Rescue Manual

Chapter 2

Section 2.10

- Visual Cognition Lab – University Of Illinois
- Viscog Productions, Inc.
- Innovation Management – Lakehead University

Section 2.12

- BCSAR Manual 1999 - Man-tracking 101: How to find and follow tracks for search and rescue – www.squidoo.com
- Filmore Mountain Search and Rescue, Team 1 – Tracking www.vcsar1.org

Section 2.12

- Search and Rescue Safety Program Guide. PEP, EMBC, 2011.
- WSIB

Section 2.13

- Criminal Investigation – Forming Reasonable Grounds – Gino Arcaro

Chapter 3

Section 3.1

- BC Ground Search and Rescue Manual
- NZ Land Search and Rescue
- OSARVA Training Manual
- Fort McMurray Search and Rescue
- Eyewitness Companions – Backpacking & Hiking; Karen Berger

Section 3.3.2

- Back Country Trail Patrol Association - Mountain Bike Search and Rescue Training Manual (online)
- Superior Search and Rescue Training Manual, 4th edition (online)

Section 3.3.3

- Field Operating Guide to Search and Rescue
- SAR Skills Handbook
- ERI Canada and ERI International 2003

Chapter 4

Section 4.1

- Environment Canada
- Public Safety Canada
- Public Health Canada
- Insects - Images taken from Google Images
- Animals - Images taken from Google Images
- Wikipedia
- Information on poisonous plants taken from the Canadian Biodiversity Information Facility Website: http://www.cbif.gc.ca/home_e.php
- Plants - Images taken from Google Images

Section 4.2

- Public Health Canada
- Google Images
- Wikipedia
- Environment Canada
- Canadian Centre for Occupational Health and Safety

Section 4.3

- Ontario Ministry of Environment
- Operation Lifesaver
- Power authority safety

Section 4.4

- Mike Doyle, SARBC, 2002

Chapter 5

Section 5.1

- Human Factors In Aircraft Maintenance - Jon Byrd

Section 5.2

- SAR Seamanship Reference Manual – Canadian Volunteer Coast Guard Team Search and Rescue

Section 5.3

- SAR Seamanship Reference Manual – Canadian Volunteer Coast Guard Team Search and Rescue

Section 5.4

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Section 5.5

- Emergency Response Institute Canada- Field Operating Guide
- Red Deer Search and Rescue
- BC Search and Rescue
- Lakehead SAR-Constitution
- Indiana Search and Rescue Association - Code of Conduct

Chapter 6

Section 6.1

- Basic Radio Communication-Cibola SAR
- Radio Procedures-www.qsl.net/sar/radio
- BC Ground Search and Rescue Manual

Section 6.2

- Emergency Response Institute Canada Field Operating Guide
- Call-out Procedures- www.grahamcountysar
- Search is an Emergency Field Guide Handbook
- Lost Person Behavior – Robert Koester
- Lost Person Behavior, Managing the Lost Person Incident- Kenneth Hill

Chapter 7

Section 7.1

- OPP Provincial Search and Rescue Coordinator Sgt J. Stirling

Section 7.3

- Knotcraft : Allan and Paulette Macfarlan
- Kids Outdoors: Victoria Logue, Frand Logue, Mark Carroll
- Emergency Response Institute, Field Operating Guide to Search and Rescue (2003)
- Internet: A variety of pictures.

Section 7.4

- OSARVA/OPP SAR Manual
- BCSAR

Section 7.5

- OSARVA/OPP SAR Manual
- Natural Resources Canada web site

Section 7.6

- Ground Team Member & Leader Reference Text (Developed as part of the National Emergency Services Curriculum Project)

Section 7.8

- Missing Person Behavior - An Aid to the Search Manager 1st edition Dave Perkins and Pete Roberts
- Northumberland National Park SRT, Centre for Search Research Ged Feeney - Penrith MRT and Mountain Rescue Council Statistics Officer
- Newfoundland and Labrador Search and Rescue Association – Searcher 11 Lesson Plans
- Emergency Response Institute of Canada – SAR Skills Handbook
- Field Operating Guide to Search and Rescue.

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- Bob Grieve – Lakehead Search and Rescue, Thunder Bay
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OSARVA Board Members – NIF Project Steering Committee:

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- Darren Buck – Treasurer, NIF Treasurer